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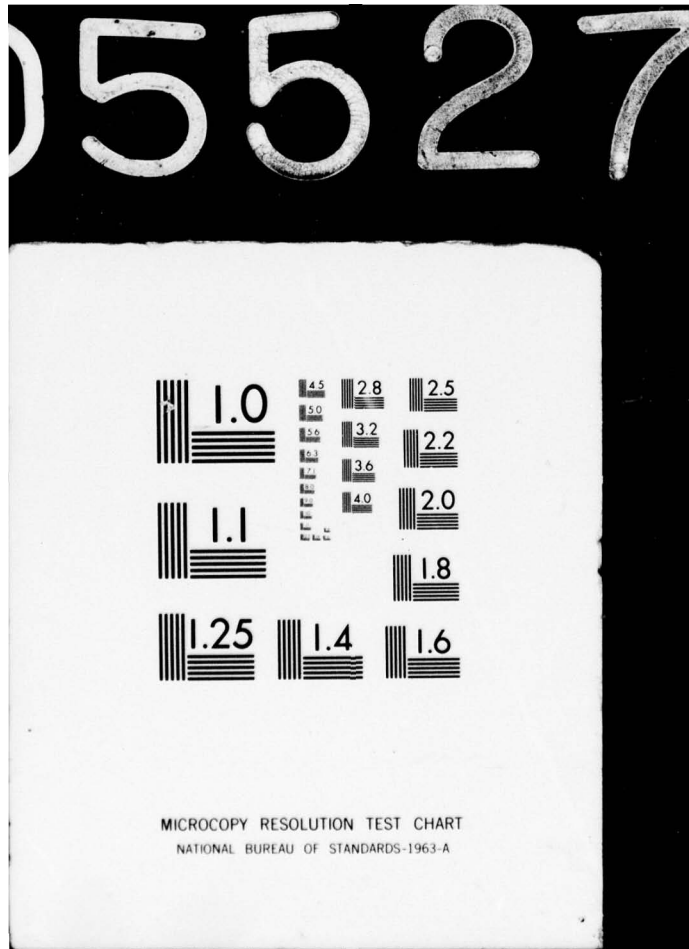
UTAH UNIV SALT LAKE CITY GRADUATE SCHOOL OF ARCHITECTURE F/G 9/2  
SERVICES TO DEVELOP POCKET COMPUTERS TO PERFORM PF CALCULATING --ETC(U)  
JAN 78 S W CRAWLEY

DCPA01-76-C-0325

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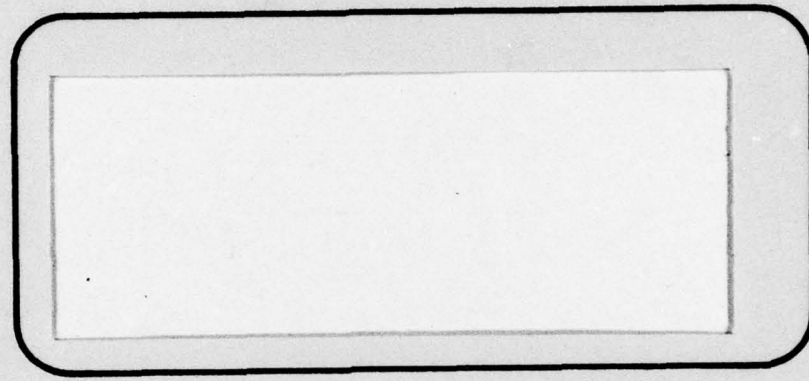




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SERVICES TO DEVELOP POCKET COMPUTERS  
TO PERFORM PF CALCULATING BY DCPA  
STANDARD METHOD AND TO PROVIDE  
TRAINING FOR USE



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# FINAL REPORT

SERVICES TO DEVELOP POCKET COMPUTERS TO PERFORM PF  
CALCULATING BY DCPA STANDARD METHOD AND TO PROVIDE  
TRAINING FOR USE

Contract Number: DCPA 01-76-6-0325

Contracting Officers  
Technical Representative: George Goforth

Approved for Public Release: Distribution Unlimited

Reporting Agency: Graduate School of Architecture  
University of Utah  
Salt Lake City, Utah 84112  
  
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Professor of Architecture

Date: January 16, 1978

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## INTRODUCTION

Although the "Standard Method" of calculating the protection factor of a shelter is well understood by qualified FSAs, it is seldom used in practice. Reasons for this are both numerous and controversial, but the fact remains that it is seldom used in practice.

The availability of programmable pocket type calculators in 1974-75 presented a new situation. It seemed, at that time, that the pocket computer might work in calculating the PF by the "Standard Method." Consequently, a feasibility study was undertaken to decide this issue.

The feasibility study was completed in December 1976 and a favorable report written and its recommendations were used as a basis for establishing the objectives of this project. In abbreviated form these objectives are:

- 1) Develop programs using "Standard Method" and broad enough to be used on either the Hewlett-Packard calculator or the Texas Instrument calculator.
- 2) Outline steps in the chips that are programmed.
- 3) Prepare a User's Manual.
- 4) Provide training to DCPA Regional personnel.

It was decided to prepare the initial programs on the Hewlett-Packard Model 97 (desk top model). These identical programs could also be used on the HP Model 67 (pocket type). These programs had to undergo significant changes before they would work on the Texas Instruments calculator. These changes were made for the TI Model SR52. About 30% more cards are required for the TI model than is necessary for the HP models. It is interesting to note at this writing that TI has produced a new Model 59 that will significantly reduce the necessary number of cards. Perhaps only one or two would be required.

The overall approach was to develop a single methodology that could be applied to either the TI or the HP calculators. The individual operation of the calculator would be different as is required by the uniqueness of the calculators. The "Standard Method's" functional equations were to be used, giving this aspect 100% accuracy. The "Standard Method" requires the use of charts and these charts had to be converted to equations that were workable on the programmed chip. It is in these equations that some accuracy is lost.

### CHART EQUATIONS

There are a limited number of steps and locations for data in each card to be programmed for use on the calculators. Consequently, it was necessary to convert into equation form all information that is contained on the charts used in the Standard Method. In a few cases this was easily achieved where there was a theoretical or derived basis for the chart. In many cases it was extremely difficult to convert the chart information into equation form.

It was decided that the accuracy should be to a + 5% for the full range of the charts. In many cases this was unrealistic for a single equation. Therefore, where necessary, more than one equation was used. A special computer program was prepared to check the accuracy of these equations. This process was explained in detail in the Second Quarterly Report dated January 5, 1977.

Appendix A lists all chart equations used in this project.

### CARD PROGRAMS FOR EQUATIONS

It was apparent from the feasibility study that a major consideration in the final developed project would be the number of programmed cards required for any PF calculation. The more cards used, the larger and more cumbersome the process. Therefore efforts were focused upon programming cards that would solve the equations for all the charts. At the time this effort was put forth, only the HP calculators were available. When all the equations were programmed successfully on separate HP cards, it was felt that to repeat this task for the TI cards would be an unnecessary duplication. The programs finalized in this phase of the study could now be used as sub-routines of the master program that solves for the PF.

Appendix B contains listings for all chart equations programmed on HP cards.

### METHODOLOGY

The "Standard Method" as described in TR-20 Vol. 1 is very fundamental and presents an understanding of the principles of radiation shielding as well as a process in which the protection factor can be calculated. It is a lengthy and detailed procedure which is seldom used in practice other than in conjunction with the SAND program. However, the so-called "freight train" function equations do lend themselves to an analytical process that



can easily be accomplished on a computer. All that is necessary is a basic breakdown into parts that can be added together by the operator of the calculator.

The basic approach is to reference a complete set of calculations and procedures to a single location of the detector. If there is need for the PF to be referenced to any other location, the process or a similar process must be repeated. The initial breakdown is in two parts: overhead contribution and ground contribution.

The overhead contribution process must be prepared so as to permit calculations for any general configuration as well as for any variety of mass thicknesses. This general case for overhead contribution is accomplished by use of two chips for the HP calculators. They are labeled 0-1a and 0-2. The TI calculator requires the use of three chips to accomplish the same thing, using basically the same methodology. These chips are labeled 0-1a1, 0-1a2 and 0-2.

Ground contribution calculations require the use of separate chips. The six HP chips are labeled GM-1, 2, 3, 4, 5 and 6 and will calculate the ground contribution for any configuration and any assembly of wall and floor material. In some cases not all six chips need to be used. The counterpart of these for the TI calculator is eight in number and labeled GM-1, 2, 3, 4, 5, 6, 7 and BR. Their use is similar to the HP chips in that not all are needed all the time.

The use of the above chips is still a lengthy process, even with the calculator making all the calculations. Therefore other "sets" of chips were prepared for special conditions that are frequently met. These special sets are called "express" chips and are fewer in number, thereby speeding up the process considerably.

The methodology and detailed use of these chips are thoroughly explained in the USER'S MANUAL, which is included in Appendix D of this report. Detailed examples are included in this manual for explanation of the process as well as in checking the validity of the chips. Whereas the basic methodology remains the same for both the HP and TI calculators, the detailed use of each calculator must be unique for each. This calls for different step-by-step explanation for each calculator and is described in this manner in the manual.

#### PROGRAMS FOR THE METHODOLOGY

The development of the programs to be placed in the chips was the major task of the project. The reasons for the finalized version of the programs are manyfold. A major objective was to require as few chips as possible. Not only was the total number of chips kept to a minimum but the sequential use of the chips was organized in such a way that with certain, frequently encountered conditions, some of the chips would be by-passed.

With but two conditions, all input data is placed when the first card program is in operation for either overhead or ground contribution. The two exceptions are for special barriers for ground or overhead contribution, and that data is input while the last card is in operation. When other cards are necessary to complete the calculations they are called for by the display and simply fed into the calculator and put into operation by pressing a continue key.

Some data that is input goes directly to a storage location while other data entries start a calculation sequence, the results of which are put into a storage location. In some chips the first input sets up an internal counter in order to display the sequence of additional input data. These are only some of the reasons and considerations that played a part in developing the programs. The programs for use on HP chips were prepared first. These were used as a basis for preparing the TI chips. Changes were required in the programs because the make-up and operation of the calculators are different. These changes were kept to a minimum.

Appendix C contains the listings for all the programmed cards. In the case of the HP chips the listing was made from the printer on the HP 97 model. To make these listings more readable they have been annotated. Since the TI did not have the same capabilities, the listing for its programs are simply shown on the SR 52 coding form.

Jack LeDoux was engaged as a consultant to this project. He proceeded to prepare a new program for calculating the contribution to a detector on a wall-to-wall basis. This program was considered as a back-up for the main program in case serious obstacles were encountered. His approach was unique in that he used a chip to load numerical data into the registers before the programs for calculating PF were loaded. This is a good program but is dependent upon the user being a master of the Standard Method. It would require considerably more work before it would become a recommended program.

#### TRAINING OF DCPA PERSONNEL

This last phase of the project was scheduled and coordinated with DCPA and regional personnel by George Goforth, the COTR. There were four one-day training sessions. Each one-day session was attended by personnel from two regions. Each region was given a set of HP cards, a set of TI cards and a USER'S MANUAL.

The schedule and personnel attending is given as follows:

October 14, 1977 at Battle Creek, Michigan

Region 1	Morris Budnick
	Robert J. Cerasulo
Region 4	Louis H. Richie
	Bruce R. Newhard
	Franklin Eglund
	James A. Colyer
	Ralph A. Myers
	Donald L. Harris

October 27, 1977 at Denver, Colorado

Region 6	Chuck Powell
	Jean LePage
	Jim McClanahan
	Monte Mingus
	Don Belew
	David Prothero
	Lyle E. Hebb
	Willard D. Froseth
Region 5	Ronald W. Morrison
	Charles V. Dansby
	Andrew J. Sidor
	Ray E. Burk

November 15, 1977 at Olney, Maryland

Region 2	R. E. Held
	Michel S. Pawlowski
	C. E. Faltot
	K. E. Edwards
	Jonathan P. Deason
	Joe Tonkin
Region 3	Roy Wilham
	Mike DeLorenzo
	Mel Schnieder
	John Griffen
Region 1	W. A. Haynes
Visitors	Tom Carroll
	Nick DiTullo
	John A. Hain
	Chuck House

November 22, 1977 at Bothell, Washington

Region 8	Barry Roenfeldt
	Bob Schleiter
	Ron Runiverstrom
	Joe Dulet
	C. B. Corativo
	Herb McElvaine
	John Lindberg
Region 7	Tom Murdock
	Ed Kaufman



The reactions from the people attending these training sessions was mixed but generally favorable. Some who attended were not at all familiar with the calculator they brought to the training session. Consequently most of their effort was spent on working the calculator and not on understanding the new method. Their opinions were not of much value.

Many who attended had forgotten a great deal of the principles of the "Standard Method." This was understandable since most had taken the FSA Course many years ago and have never used it since they became FSA qualified. These people were used to working with the SAND or the EASY method.

Everyone seemed pleased with the accuracy of the new method. Everyone liked the idea of not having to look up values on charts. Nearly everyone appeared relieved at the almost eliminated mathematical error. The new method was readily understandable and no one seriously challenged the new methodology.

There was a general consensus that too many chips had to be loaded and this took too much time. Objectionable as this was, most indicated that they would use the new method.

#### CONCLUSIONS AND RECOMMENDATIONS

FSA by pocket computers is now a reality. The method is easy to understand and easy to use and it produces an accurate PF value. The program cards and USER'S MANUAL should be made available for anyone involved in shelter calculations.

The method should be taught near the end of the regular FSA Course and it should be included in the correspondence course.

Every effort should be made to keep current with the development of late model calculators. Many of the newer calculators have much larger memories and more program capabilities. It is probable that in the near future only one or two chips would have to be used, even for the most complex building. The methodology and programs used in this, now finished, project should be easily adapted to these newer models.

APPENDIX A  
to  
FINAL REPORT

E Q U A T I O N S F O R A L L C H A R T S

SERVICES TO DEVELOP POCKET CALCULATORS TO PERFORM PF CALCULATIONS  
BY DCPA STANDARD METHOD AND TO PROVIDE TRAINING FOR USE

Contract Number DCPA01-76-C-0325

EQUATION USED FOR CHARTS  
FROM THE "STANDARD METHOD"

CHART 1A: SOLID ANGLE FRACTION (Derived)

$$\omega = \frac{2}{\pi} \tan^{-1} \left[ \frac{e}{2a \sqrt{4a^2 + e^2 + 1}} \right]$$

where  $e = \frac{W}{L}$

$$a = \frac{Z}{L}$$

CHART 1B: LIMITED FIELD SOLID ANGLE FRACTION (Derived)

$$2\omega_s = \tan^{-1} \left[ \frac{W_c}{H} \right]$$

CHART 2: GEOMETRY FACTORS, SCATTER AND SKY SHINE (Gregory)

When  $\omega \leq 0.7$

$$G_a = 0.102 (1-\omega)^{.465}$$

When  $0.7 < \omega < 0.85$

$$G_a = 0.148 (1-\omega)^{.779}$$

When  $0.85 \leq \omega$

$$G_a = 0.222 (1-\omega)^{.988}$$

In all cases

$$G_s = 5 G_a$$

CHART 3A & 3B; GEOMETRY FACTOR, Direct (Gregory)

$$\text{Compute } G_d = 0.923392H^{-.019273} + 0.158403H^{.230341} \text{Log}(1-\omega)$$

$$\text{if } G_d \leq 0.25$$

$$\text{Compute } G_d = 0.014035H^{.322605} - 8.630295H^{(-.472326)} \text{Log } \omega$$

$$\text{if } G_d < .04 \text{ and } H \geq 20$$

$$\text{Compute } G_d = -0.093885H^{-.459686} - 12.771735H^{-.694395} \text{Log } \omega$$

CHART 4: SHAPE FACTOR (Derived)

$$E = \frac{1+e}{\sqrt{1+e^2}} \quad \text{Where } e = \frac{W}{L}$$

CHART 5; SCATTER FRACTION, (Gregory)

$$\text{When } X < 13$$

$$S_w = \frac{X}{X + 37}$$

$$\text{When } 13 \leq X \leq 35$$

$$S_w = \frac{X}{X + 34}$$

$$\text{When } X > 35$$

$$S_w = \frac{X}{X + 30}$$



CHART 6; EXTERIOR WALL BARRIER FACTOR (LeDoux)

$$B_e = \left[ 0.3e^{-.0408X} + 0.7e^{-.0209X} \right] \left[ (0.28 - 0.00054X)e^{-.00228H} + 0.3e^{-.009H} \right] \\ = (0.232 + 0.00066X)e^{-.03H} + 4e^{-.2H}$$

Where  $e = 2.718282$ CHART 7; INTERIOR PARTITION ATTENUATION FACTORS (Gregory)When  $X \leq 20$ 

$$B_i = 0.9885e^{-.037X}$$

When  $20 < X \leq 90$ 

$$B_i = 0.8001e^{-.02723X}$$

When  $X > 90$ 

$$B_i = 0.53852e^{-.02303X}$$

When  $X \leq 110$ 

$$B_i = 1.00316e^{-.0239X}$$

When  $X > 110$ 

$$B_i = 0.7405e^{-.02108X}$$

Where  $e = 2.718282$



CHART 8A; CEILING ATTENUATION FACTOR (Derived)

A-4

$$B_c = (1 - 3.5e^{-.23\omega}) (e^{-.1X}) + (3.5e^{-2.3\omega}) (e^{-.04X})$$

Where  $e = 2.718282$

CHART 8B; FLOOR ATTENUATION FACTOR (Gregory)

When  $2.5 \leq X \leq 10$

$$B_f = 0.8287X^{-.3999}$$

When  $X < 2.5$

$$B_f = e^{-.2248X}$$

When  $X > 10$

$$B_f = (10^{-.00938X}) X^{-.38}$$

Where  $e = 2.718282$

CHART 9; OVERHEAD CONTRIBUTION (LeDoux)

$$C_o = 0.322e^{-.02239(X_o + \Delta X_o)} \omega^{1.03 - .00046X_o}$$

When  $\omega < .1$

$$\Delta X_o = 0$$

When  $\omega \geq .1$

$$\Delta X_o = (1.3 - 1.6e^{-.01674X_o}) (30.3\omega^{1.1} - .234\omega^{.7345})$$

$$\text{if } X_o = 0$$

and if  $C_o$  as calculated above is

$$0.0011 < C_o < 0.17$$

then use

$$C_o = (C_o) (0.9)$$

in all cases  $e = 2.718282$

CHART 10A; LIMITED FIELD BARRIER FACTOR

A-5

When  $X = 0$

$$B_s = 0.2323(2\omega_s)^{1.05}$$

When  $X > 0$

$$B_s = (0.279e^{-0.0223X})(2\omega_s)^{.9764X \cdot 2157}$$

If  $B_s$  as calculated above  $< 0.002$

and  $20 \leq X \leq 75$  Than use

$$B_s = 1.2B_s$$

CHART 10B; LIMITED FIELD HEIGHT FACTOR

$$F_s = (0.22 + \frac{H-3}{H+120})^{5-10(\frac{2\omega_s}{2})}$$

If  $2\omega_s = 1$ , Use as calculated above

If  $H = 3$  and  $2\omega_s > 0.84$

$$\text{Use } F_s = 0.9F_s$$

If  $H \geq 40$  and  $0.84 \leq 2\omega_s \leq 0.96$

$$\text{Use } F_s = 1.1F_s$$

in all other cases

$$\text{Use } F_s = 1.05F_s$$

CHART 11; PASSAGEWAYS AND SHAFTS (Gregory)

Passageways

$$C = 5\omega^{.608}$$

Shafts

When  $\omega > 0.9$

$$C = 0.86906\omega^{5.98015}$$

When  $0.75 \leq \omega \leq 0.9$

$$C = 0.6233\omega^{2.70493}$$

When  $0.345 < \omega < 0.75$

$$C = 0.41357\omega^{1.35544}$$

When  $\omega \leq 0.345$

$$C = 2.872\omega^{1.0177}$$

APPENDIX B  
to  
FINAL REPORT

C A R D P R O G R A M S F O R E Q U A T I O N S

(HP cards only)

SERVICES TO DEVELOP POCKET CALCULATORS TO PERFORM PF CALCULATIONS  
BY DCPA STANDARD METHOD AND TO PROVIDE TRAINING FOR USE

Contract Number DCPA01-76-C-0325

# CHART 1A SOLID ANGLE FRACTION

B-1

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LELA	21 11					
002	STG1	35 01					
003	RTN	24					
004	*LELE	21 12					
005	STG2	35 02					
006	RTN	24					
007	*LELC	21 13					
008	STG3	35 03					
009	RTN	24					
010	*LELD	21 14					
011	RCL1	36 01					
012	RCL2	36 02					
013	÷	-24					
014	STG4	35 04					
015	RCL3	36 03					
016	RCL2	36 02					
017	÷	-24					
018	STG5	35 05					
019	RCL4	36 04					
020	RCL5	36 05					
021	X²	53					
022	4	04					
023	X	-35					
024	RCL4	36 04					
025	X²	53					
026	+	-55					
027	1	01					
028	+	-55					
029	JX	54					
030	2	02					
031	X	-35					
032	RCL5	36 05					
033	X	-35					
034	÷	-24					
035	RAD	16-22					
036	TAN⁻¹	16 43					
037	2	02					
038	X	-35					
039	P1	16-24					
040	÷	-24					
041	RTN	24					
042	R/S	51					

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J



**B-2**

[illegible]

# CHART 2 GEOMETRY FACTORS, SCATTER & SKYSHINE

B-3

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	SSBE	23 12	
002	ST01	35 01		058	5	05	
003	RTN	24		059	X	-35	
004	*LBLB	21 12		060	RTN	24	
005	.	-62		061	F 3	51	
006	7	07					
007	RCL1	36 01					
008	X*Y?	16-35					
009	GT01	22 01					
010	.	-62					
011	8	08					
012	5	05					
013	X*Y?	16-34					
014	GT02	22 02		070			
015	.	-62					
016	2	02					
017	2	02					
018	2	02					
019	ENT↑	-21					
020	.	-62					
021	9	09					
022	8	08					
023	6	08					
024	*LBL3	21 02		080			
025	ST02	35 02					
026	R↓	-31					
027	1	01					
028	RCL1	36 01					
029	-	-45					
030	RCL2	36 02					
031	Y*	31					
032	X	-35					
033	RTN	24					
034	*LBL1	21 01		090			
035	.	-62					
036	1	01					
037	0	00					
038	2	02					
039	ENT↑	-21					
040	.	-62					
041	4	04					
042	6	06					
043	5	05					
044	GT03	22 03		100			
045	*LBL2	21 02					
046	.	-62					
047	1	01					
048	4	04					
049	8	08					
050	ENT↑	-21					
051	.	-62					
052	7	07					
053	7	07					
054	9	09		110			
055	GT03	22 03					
056	*LBLC	21 13					

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

# CHART 3A & 3B GEOMETRY FACTOR, DIRECT

B-4

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	R↓	-31	
002	STO1	35 01		058	.	-62	
003	RTN	24		059	2	02	
004	*LBLB	21 12		060	5	05	
005	STO2	35 02		061	X=Y	-41	
006	RTN	24		062	X/Y?	16-34	
007	*LBLC	21 13		063	RTN	24	
008	1	01		064	RCL2	36 02	
009	RCL1	36 01		065	.	-62	
010	-	-45		066	3	03	
011	X=02	16-43		067	2	02	
012	RTN	24		068	2	02	
013	RCL2	36 02		069	6	06	
014	.	-62		070	Y*	31	
015	0	00		071	.	-62	
016	1	01		072	0	00	
017	9	09		073	1	01	
018	3	03		074	4	04	
019	CHS	-22		075	0	00	
020	Y*	31		076	4	04	
021	.	-62		077	CHS	-22	
022	9	09		078	x	-35	
023	2	02		079	RCL2	36 02	
024	3	03		080	.	-62	
025	4	04		081	4	04	
026	x	-35		082	7	07	
027	RCL2	36 02		083	2	02	
028	.	-62		084	3	03	
029	2	02		085	CHS	-22	
030	3	03		086	Y*	31	
031	0	00		087	8	08	
032	3	03		088	.	-62	
033	Y*	31		089	6	06	
034	.	-62		090	3	03	
035	1	01		091	CHS	-22	
036	5	05		092	x	-35	
037	8	08		093	RCL1	36 01	
038	4	04		094	LN	32	
039	x	-35		095	x	-35	
040	1	01		096	+	-55	
041	RCL1	36 01		097	.	-62	
042	-	-45		098	0	00	
043	LN	32		099	4	04	
044	x	-35		100	X=Y	-41	
045	+	-55		101	X/Y?	16-34	
046	RCL2	36 02		102	RTN	24	
047	3	03		103	RCL2	36 02	
048	X/Y?	16-34		104	2	02	
049	STO2	22 02		105	0	00	
050	R↓	-31		106	X/Y?	16-34	
051	R↓	-31		107	STO1	22 01	
052	X/Y?	16-34		108	R↓	-31	
053	0	00		109	R↓	-31	
054	RTN	24		110	RTN	24	
055	*LBL2	21 02		111	*LBL1	21 01	
056	R↓	-31		112	RCL2	36 02	

LABELS						FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP	
a	b	c	d	e	1	ON OFF			
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>	
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>	
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>	
						3 <input type="checkbox"/> <input type="checkbox"/>		n _____	



# CHART 3A & 3B (Continued)

B-5

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	.	-62					
114	4	04					
115	5	05					
116	9	09					
117	7	07					
118	CHS	-22					
119	YX	31					
120	.	-62					
121	0	00					
122	9	09					
123	3	03					
124	6	06					
125	9	09					
126	CHS	-22					
127	X	-35					
128	RCL2	36 02					
129	.	-62					
130	6	06					
131	9	09					
132	4	04					
133	4	04					
134	CHS	-22					
135	YX	31					
136	1	01					
137	2	02					
138	.	-62					
139	7	07					
140	7	07					
141	CHS	-22					
142	X	-35					
143	RCL1	36 01					
144	LN	32					
145	X	-35					
146	+	-55					
147	.	-62					
148	0	00					
149	0	00					
150	6	06					
151	X>Y?	16-34					
152	GT03	22 03					
153	R4	-31					
154	RTN	24					
155	*LBL3	21 03					
156	1	01					
157	RCL1	36 01					
158	-	-45					
159	.	-62					
160	3	03					
161	X	-35					
162	RTN	24					
163	R/S	51					

LABELS					FLAGS	SET STATUS		
	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>		n
						3 <input type="checkbox"/> <input type="checkbox"/>		



**B-6**

[illegible]

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

## B-7

[illegible]

# CHART 6. EXTERIOR WALL BARRIER FACTOR

8-8

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LELA	21 11		057	CHS	-22	
002	ST01	35 01		058	RCL2	36 02	
003	RTN	24		059	x	-35	
004	*LELE	21 12		060	e <sup>x</sup>	-33	
005	ST02	35 02		061	.	-62	
006	RTN	24		062	0	00	
007	*LBLC	21 13		063	0	00	
008	.	-62		064	0	00	
009	2	02		065	5	05	
010	CHS	-22		066	4	04	
011	RCL2	36 02		067	CHS	-22	
012	x	-35		068	RCL1	36 01	
013	e <sup>x</sup>	33		069	x	-35	
014	.	-62		070	.	-62	
015	4	04		071	2	02	
016	x	-35		072	0	00	
017	.	-62		073	+	-55	
018	0	00		074	x	-35	
019	3	03		075	+	-55	
020	CHS	-22		076	.	-62	
021	RCL2	36 02		077	0	00	
022	x	-35		078	2	02	
023	e <sup>x</sup>	33		079	0	00	
024	.	-62		080	9	09	
025	0	00		081	CHS	-22	
026	0	00		082	RCL1	36 01	
027	0	00		083	x	-35	
028	6	06		084	e <sup>x</sup>	33	
029	6	06		085	.	-62	
030	RCL1	36 01		086	7	07	
031	x	-35		087	x	-35	
032	.	-62		088	.	-62	
033	2	02		089	0	00	
034	3	03		090	4	04	
035	2	02		091	0	00	
036	+	-55		092	0	00	
037	x	-35		093	CHS	-22	
038	+	-55		094	RCL1	36 01	
039	.	-62		095	x	-35	
040	0	00		096	e <sup>x</sup>	33	
041	0	00		097	.	-62	
042	9	09		098	3	03	
043	CHS	-22		099	x	-35	
044	RCL2	36 02		100	+	-55	
045	x	-35		101	x	-35	
046	e <sup>x</sup>	33		102	1	01	
047	.	-62		103	XZY	-41	
048	3	03		104	XZY?	16-34	
049	x	-35		105	1	01	
050	+	-55		106	RTN	24	
051	.	-62		107	R/S	51	
052	0	00					
053	0	00					
054	2	02					
055	2	02					
056	0	00					

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



# CHART 7 INTERIOR PARTITION ATTENUATION FACTOR

B-9

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LELA	21 11		057	0	00	
002	ST01	35 01		058	3	03	
003	RTN	24		059	7	07	
004	*LELE	21 12		060	CHS	-22	
005	1	01		061	x	-35	
006	1	01		062	e <sup>x</sup>	33	
007	0	00		063	.	-62	
008	RCL1	36 01		064	.	09	
009	XYY?	16-34		065	8	08	
010	GT01	22 01		066	8	08	
011	.	-62		067	5	05	
012	6	00		068	x	-35	
013	2	02		069	RTN	24	
014	3	03		070	*LBL2	21 02	
015	9	09		071	9	09	
016	CHS	-22		072	0	00	
017	x	-35		073	RCL1	36 01	
018	e <sup>x</sup>	33		074	XYY?	16-34	
019	1	01		075	GT03	22 03	
020	.	-62		076	.	-62	
021	0	00		077	0	00	
022	0	00		078	2	02	
023	3	03		079	7	07	
024	1	01		080	2	02	
025	6	06		081	3	03	
026	x	-35		082	CHS	-22	
027	1	01		083	x	-35	
028	XYY	-41		084	e <sup>x</sup>	33	
029	XYY?	16-34		085	.	-62	
030	1	01		086	5	05	
031	RTN	24		087	0	00	
032	*LBL1	21 01		088	0	00	
033	.	-62		089	1	01	
034	0	00		090	x	-35	
035	2	02		091	RTN	24	
036	1	01		092	*LBL3	21 03	
037	0	00		093	RCL1	36 01	
038	6	06		094	.	-62	
039	CHS	-22		095	0	00	
040	RCL1	36 01		096	2	02	
041	x	-35		097	3	03	
042	e <sup>x</sup>	33		098	0	00	
043	.	-62		099	3	03	
044	7	07		100	CHS	-22	
045	4	04		101	x	-35	
046	0	00		102	e <sup>x</sup>	33	
047	5	05		103	.	-62	
048	x	-35		104	5	05	
049	RTN	24		105	3	03	
050	*LBL0	21 13		106	8	08	
051	2	02		107	5	05	
052	0	00		108	2	02	
053	RCL1	36 01		109	x	-35	
054	XYY?	16-34		110	RTN	24	
055	GT02	22 02		111	R/S	51	
056	.	-62					

LABELS						FLAGS	SET STATUS		
A	B	C	D	E	0		FLAGS	TRIG	DISP
a	b	c	d	e	1		ON OFF		
0	1	2	3	4	2		0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
							1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
							2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
5	6	7	8	9	3		3 <input type="checkbox"/> <input type="checkbox"/>		n _____

# CHART 8A & 8B CEILING & FLOOR ATTENUATION FACTORS

0-10

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	STO2	35 02	
002	STO5	35 05		058	RTN	24	
003	RTN	24		059	*LBLB	21 15	
004	*LBLB	21 12		060	RCL2	36 02	
005	STO1	35 01		061	2	02	
006	RTN	24		062	.	-62	
007	*LBLC	21 13		063	5	05	
008	1	01		064	X=Y?	16-35	
009	ENT↑	-31		065	CTO3	22 03	
010	3	03		066	R↓	-31	
011	.	-62		067	.	-62	
012	5	05		068	2	02	
013	ENT↑	-31		069	2	02	
014	2	02		070	4	04	
015	.	-62		071	8	08	
016	3	03		072	CHS	-22	
017	RCL1	36 01		073	x	-35	
018	x	-35		074	e <sup>x</sup>	33	
019	CHS	-22		075	RTN	24	
020	e <sup>x</sup>	33		076	*LBL3	21 03	
021	x	-35		077	R↓	-31	
022	-	-45		078	1	01	
023	.	-62		079	8	08	
024	1	01		080	X=Y	-41	
025	CHS	-22		081	X=Y?	16-35	
026	RCL5	36 05		082	CTO4	22 04	
027	x	-35		083	ENT↑	-21	
028	e <sup>x</sup>	33		084	ENT↑	-21	
029	x	-35		085	.	-62	
030	3	03		086	3	03	
031	.	-62		087	8	08	
032	5	05		088	CHS	-22	
033	ENT↑	-31		089	Y*	31	
034	2	02		090	X=Y	-41	
035	.	-62		091	.	-62	
036	3	03		092	8	08	
037	RCL1	36 01		093	8	08	
038	x	-35		094	9	09	
039	CHS	-22		095	3	03	
040	e <sup>x</sup>	33		096	8	08	
041	x	-35		097	CHS	-22	
042	.	-62		098	x	-35	
043	8	08		099	10 <sup>x</sup>	16 33	
044	4	04		100	x	-35	
045	CHS	-22		101	RTN	24	
046	RCL5	36 05		102	*LBL4	21 04	
047	x	-35		103	.	-62	
048	e <sup>x</sup>	33		104	3	03	
049	x	-35		105	9	09	
050	+	-55		106	9	09	
051	1	01		107	9	09	
052	X=Y	-41		108	CHS	-22	
053	X=Y?	16-34		109	Y*	31	
054	1	01		110	.	-62	
055	RTN	24		111	8	08	
056	*LBLD	21 14		112	2	02	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

**B-11**

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



# CHART 9 OVERHEAD CONTRIBUTION

B-12

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	x	-35	
002	STO1	35 01		058	-	-45	
003	RTN	24		059	x	-35	
004	*LBLB	21 12		060	*LBL2	21 02	
005	STO2	35 02		061	RCL1	36 01	
006	RTN	24		062	+	-55	
007	*LBLC	21 13		063	.	-62	
008	RCL2	36 02		064	0	00	
009	.	-62		065	2	02	
010	1	01		066	2	02	
011	XZY?	16-35		067	3	03	
012	GT01	22 01		068	9	09	
013	0	00		069	CHS	-22	
014	GT02	22 02		070	x	-35	
015	*LBL1	21 01		071	e <sup>x</sup>	33	
016	1	01		072	.	-62	
017	.	-62		073	3	03	
018	3	03		074	2	02	
019	ENT↑	-21		075	2	02	
020	.	-62		076	x	-35	
021	0	00		077	RCL2	36 02	
022	1	01		078	RCL1	36 01	
023	6	06		079	.	-62	
024	7	07		080	0	00	
025	4	04		081	0	00	
026	CHS	-22		082	0	00	
027	RCL1	36 01		083	4	04	
028	x	-35		084	6	06	
029	e <sup>x</sup>	33		085	CHS	-22	
030	1	01		086	x	-35	
031	.	-62		087	1	01	
032	6	06		088	.	-62	
033	x	-35		089	0	00	
034	-	-45		090	3	03	
035	RCL2	36 02		091	+	-55	
036	1	01		092	Y <sup>x</sup>	31	
037	.	-62		093	x	-35	
038	1	01		094	RCL1	36 01	
039	Y <sup>x</sup>	31		095	X#0?	16-42	
040	3	03		096	GT03	22 03	
041	0	00		097	XZY	-41	
042	.	-62		098	.	-62	
043	3	03		099	1	01	
044	x	-35		100	7	07	
045	RCL2	36 02		101	XZY?	16-35	
046	.	-62		102	GT03	22 03	
047	7	07		103	XZY	-41	
048	3	03		104	.	-62	
049	4	04		105	0	00	
050	5	05		106	0	00	
051	CHS	-22		107	1	01	
052	Y <sup>x</sup>	31		108	1	01	
053	.	-62		109	XZY?	16-34	
054	2	02		110	GT03	22 03	
055	3	03		111	XZY	-41	
056	4	04		112	.	-62	

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n_____

**B-13**

[illegible]



# CHART 10A LIMITED FIELD BARRIER FACTOR

B-14

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	STO3	35 03	
002	STO1	35 01		058	.	-62	
003	RTN	24		059	0	00	
004	*LBLB	21 12		060	0	00	
005	STO2	35 02		061	2	02	
006	RTN	24		062	X=Y?	16-35	
007	*LBLC	21 13		063	STO3	22 03	
008	RCL2	36 02		064	*LBL4	21 04	
009	RCL1	36 01		065	RCL3	36 03	
010	X=0?	16-43		066	RTN	24	
011	STO1	22 01		067	*LBL3	21 03	
012	.	-62		068	7	07	
013	2	02		069	5	05	
014	1	01		070	RCL1	36 01	
015	5	05		071	X=Y?	16-35	
016	7	07		072	STO5	22 05	
017	YX	31		073	STO4	22 04	
018	.	-62		074	*LBL5	21 05	
019	9	09		075	2	02	
020	7	07		076	0	00	
021	6	06		077	X=Y?	16-35	
022	4	04		078	STO6	22 06	
023	X	-35		079	STO4	22 04	
024	YX	31		080	*LBL6	21 06	
025	.	-62		081	RCL3	36 03	
026	2	02		082	1	01	
027	7	07		083	.	-62	
028	9	09		084	2	02	
029	X	-35		085	X	-35	
030	RCL1	36 01		086	RTN	24	
031	.	-62		087	RTN	24	
032	0	00		088	R/S	51	
033	2	02					
034	2	02					
035	3	03					
036	4	04					
037	2	02					
038	CHS	-22					
039	X	-35					
040	e <sup>X</sup>	33					
041	X	-35					
042	STO2	22 02					
043	*LBL1	21 01					
044	RCL2	36 02					
045	1	01					
046	.	-62					
047	0	00					
048	5	05					
049	YX	31					
050	.	-62					
051	2	02					
052	3	03					
053	2	02					
054	3	03					
055	X	-35					
056	*LBL2	21 02					

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>		n _____
						3 <input type="checkbox"/> <input type="checkbox"/>		

# CHART 10B LIMITED FIELD HEIGHT FACTOR

8-15

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LELA	21 11		057	.	-62	
002	ST02	35 02		058	9	09	
003	RTN	24		059	6	06	
004	*LBL5	21 12		060	RCL1	36 01	
005	ST01	35 01		061	X>Y?	16-34	
006	RTN	24		062	GT02	22 02	
007	*LBLC	21 13		063	.	-62	
008	RCL3	36 03		064	8	08	
009	3	03		065	4	04	
010	-	-45		066	X>Y?	16-34	
011	RCL2	36 02		067	GT02	22 02	
012	1	01		068	1	01	
013	2	02		069	.	-62	
014	0	00		070	1	01	
015	+	-55		071	STx3	35-35 03	
016	÷	-24		072	GT01	22 01	
017	.	-62		073	*LBL2	21 02	
018	2	02		074	1	01	
019	2	02		075	.	-62	
020	+	-55		076	0	00	
021	1	01		077	5	05	
022	RCL1	36 01		078	STx3	35-35 03	
023	-	-45		079	*LBL1	21 01	
024	5	05		080	RCL3	36 03	
025	x	-35		081	RTN	24	
026	Yx	31		082	R/S	51	
027	ST03	35 03					
028	1	01					
029	RCL1	36 01					
030	X=Y?	16-33					
031	GT01	22 01					
032	.	-62					
033	8	08					
034	4	04					
035	XxY	-41					
036	XxY?	16-35					
037	GT03	22 03					
038	3	03					
039	RCL2	36 02					
040	XxY?	16-32					
041	GT03	22 03					
042	.	-62					
043	9	09					
044	STx3	35-35 03					
045	GT01	22 01					
046	*LBL3	21 03					
047	RCL2	36 02					
048	2	02					
049	0	00					
050	X>Y?	16-34					
051	GT01	22 01					
052	RCL2	36 02					
053	4	04					
054	0	00					
055	X>Y?	16-34					
056	GT02	22 02					

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

## B-16

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LELA	21 11		057	3	03	
002	STC1	35 01		058	YK	31	
003	RTN	24		059		-62	
004	*LELE	21 12		060	6	05	
005	RCL1	35 01		061	2	02	
006	.	-62		062	3	03	
007	6	06		063	3	03	
008	8	08		064	x	-35	
009	8	08		065	RTN	24	
010	YK	31		066	*LBL2	21 02	
011	.	-62		067	XZY	-41	
012	5	05		068	1	01	
013	x	-35		069	.	-62	
014	RTN	24		070	3	03	
015	*LBLC	21 13		071	5	05	
016	.	-62		072	5	05	
017	3	03		073	4	04	
018	4	04		074	4	04	
019	5	05		075	YK	31	
020	RCL1	35 01		076	.	-62	
021	XZY?	16-35		077	4	04	
022	GT01	22 01		078	1	01	
023	.	-62		079	3	03	
024	7	07		080	5	05	
025	5	05		081	7	07	
026	XZY?	16-34		082	x	-35	
027	GT02	22 02		083	RTN	24	
028	RJ	-31		084	*LBL1	21 01	
029	.	-62		085	1	01	
030	9	09		086	.	-62	
031	XZY	-41		087	0	00	
032	XZY?	16-35		088	1	01	
033	GT03	22 03		089	7	07	
034	5	05		090	7	07	
035	.	-62		091	YK	31	
036	9	09		092	.	-62	
037	8	08		093	2	02	
038	8	08		094	8	08	
039	1	01		095	7	07	
040	5	05		096	2	02	
041	YK	31		097	x	-35	
042	.	-62		098	RTN	24	
043	8	08		099	R/S	51	
044	6	06					
045	9	09					
046	0	00					
047	6	06					
048	x	-35					
049	RTN	24					
050	*LBL3	21 03					
051	2	02					
052	.	-62					
053	7	07					
054	0	00					
055	4	04					
056	9	09					

LABELS					FLAGS	SET STATUS			
A	B	C	D	E	0	FLAGS		TRIG	DISP
a	b	c	d	e	1	ON OFF			
0	1	2	3	4	2	0	<input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1	<input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2	<input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
15	6	7	8	9	3	3	<input type="checkbox"/> <input type="checkbox"/>		n_____



APPENDIX C  
to  
FINAL REPORT

P. R O G R A M L I S T I N G F O R A L L C H I P S

SERVICES TO DEVELOP POCKET CALCULATORS TO PERFORM PF CALCULATIONS  
BY DCPA STANDARD METHOD AND TO PROVIDE TRAINING FOR USE

Contract Number DCPA01-76-C-0325

## CARD 0-1a Co, OFF CENTER DETECTOR

C-1

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	RTN	24	
002	STO5	35 05		058	CHS	-22	then return, else
003	R↓	-31	input	059	RTN	24	change sign of $\omega_i$
004	STO4	35 04		060	*LBLD	21 14	and then return
005	R↓	-31		061	RCL2	36 02	start subroutine for $\omega_0$
006	STO3	35 03	$X_1, X_2, Y_1, Y_2$	062	RCL4	36 04	
007	R↓	-31		063	GSBe	23 16 15	compute $\omega_1$
008	STO2	35 02		064	STO6	35 06	
009	RTN	24		065	RCL2	36 02	
010	*LBLB	21 12		066	RCL5	36 05	compute $\omega_2$
011	STO6	35 12	input $Z$	067	GSBe	23 16 15	
012	RTN	24		068	STO7	35 07	
013	*LBLC	21 13		069	RCL3	36 03	
014	STOC	35 13	input $X_0$	070	RCL4	36 04	compute $\omega_4$
015	RTN	24		071	GSBe	23 16 15	
016	*LBL E	21 16 15	start subroutine for $\omega_i$	072	STO9	35 09	
017	SF1	16 21 01	set Flag 1	073	RCL3	36 03	
018	STO6	35 06	save $X \cdot Y$ in $R_0$	074	RCL5	36 05	compute $\omega_3$
019	ABS	15 31	and keep $k$ and	075	GSBe	23 16 15	
020	X $\leftrightarrow$ Y	-41	$k$ on stack	076	STO8	35 08	
021	STx0	35-35 00		077	0	00	zero $R_0$
022	ABS	16 31		078	STO0	35 00	
023	X $\times$ Y?	16-34	smallest dimension	079	RCLC	36 13	
024	X $\times$ Y	-41	in $R_x$	080	.	-62	if $X_0 \leq .2$
025	X=0?	16-43	if $\omega$ dimension is 0	081	2	02	$X_0 \leftarrow .2$
026	RTN	24	return $\omega_i = 0$	082	X $\times$ Y?	16-35	
027	X $\times$ Y	-41	largest dimension in $R_x$	083	GT01	22 01	
028	RCL0	36 00	if $X \cdot Y < 0$	084	STOC	35 13	
029	X(0?)	16-45	clear Flag 1	085	*LBL1	21 01	set up index for $R_i$
030	CF1	16 22 01		086	9	09	
031	R↓	-31	compute $\omega_i$ as follows	087	STO1	35 46	
032	STOE	35 15		088	*LBL2	21 02	get next $\omega$
033	=	-24		089	RCL1	36 45	set Flag 1
034	STOD	35 14		090	SF1	16 21 01	if $\omega > 0$ go to
035	RCLB	36 12		091	X(0?)	16-44	compute $\omega_0$
036	RCL E	36 15		092	GT06	22 06	if $\omega = 0$ go to
037	=	-24		093	X=0?	16-43	finished
038	ENT↑	-21		094	GT05	22 05	if $\omega < 0$ clear Flag 1
039	X $\times$	53		095	CF1	16 22 01	$ \omega $ on stack
040	RCLD	36 14		096	ABS	16 31	$ \omega $ in memory
041	X $\times$	53		097	STO1	35 45	start computation for $\omega_0$
042	+	-55		098	*LBL6	21 06	
043	1	01		099	.	-62	
044	+	-55		100	1	01	if $\omega < .1$
045	JX	54		101	X $\times$ Y?	16-35	$\Delta X_0 = 0$
046	X	-35		102	GT04	22 04	
047	RCLD	36 14		103	0	00	
048	X $\times$ Y	-41		104	GT08	22 08	
049	=	-24		105	*LBL4	21 04	else
050	RAD	16-22		106	1	01	
051	TAN↑	16-43		107	.	-62	
052	2	02		108	3	03	compute $\Delta X_0$
053	X	-35		109	ENT↑	-21	as follows
054	P↑	16-24		110	.	-62	
055	=	-24		111	0	00	
056	F1?	16 23 01	if Flag 1 is set	112	1	01	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				





STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	7	07	
002	STO3	35 03	input W	058	4	04	
003	RTN	24		059	CHS	-22	
004	*LBLB	21 12		060	RCL1	36 01	
005	STO4	35 04	input L	061	x	-35	
006	RTN	24		062	e <sup>x</sup>	33	
007	*LRLC	21 13		063	1	01	
008	STO5	35 05	input Z	064	.	-62	
009	RTN	24		065	6	06	
010	*LBLD	21 14		066	x	-35	
011	STO1	35 01	input X <sub>0</sub>	067	-	-45	
012	RTN	24		068	RCL2	36 02	
013	*LBL E	21 15	start computation	069	1	01	
014	RCL3	36 03	for C <sub>0</sub>	070	.	-62	
015	RCL4	36 04		071	1	01	
016	÷	-24	$e = \frac{W}{L}$	072	Y <sup>x</sup>	31	
017	STO6	35 06	$a = \frac{Z}{L}$	073	3	03	
018	RCL5	36 05		074	0	00	
019	RCL4	36 04		075	.	-62	
020	÷	-24		076	3	03	
021	2	02		077	x	-35	
022	x	-35		078	RCL2	36 02	
023	ENT↑	-21		079	.	-62	
024	X <sup>2</sup>	53		080	7	07	
025	RCL6	36 06		081	3	03	
026	X <sup>2</sup>	53		082	4	04	
027	+	-55		083	5	05	
028	1	01		084	CHS	-22	
029	+	-55		085	Y <sup>x</sup>	31	
030	JX	54		086	.	-62	
031	x	-35		087	2	02	
032	RCL6	36 06		088	3	03	
033	X <sup>2</sup> Y	-41		089	4	04	
034	÷	-24		090	x	-35	
035	RAD	16-22		091	-	-45	
036	TAN <sup>-1</sup>	16 43		092	x	-35	
037	2	02		093	*LBL2	21 02	
038	x	-35		094	RCL1	36 01	
039	Pi	16-24		095	+	-55	
040	÷	-24		096	.	-62	
041	STO2	35 02	save W in R <sub>2</sub>	097	0	00	
042	.	-62		098	2	02	
043	1	01		099	2	02	
044	X <sup>2</sup> Y?	16-35		100	3	03	
045	STD1	22 01	if W < .1	101	9	09	
046	0	00	ΔX <sub>0</sub> = 0	102	CHS	-22	
047	STD2	22 02		103	x	-35	
048	*LBL1	21 01	else	104	e <sup>x</sup>	33	
049	1	01	compute ΔX <sub>0</sub>	105	.	-62	
050	.	-62	as follows	106	3	03	
051	3	03		107	2	02	
052	ENT↑	-21		108	2	02	
053	.	-62		109	x	-35	
054	0	00		110	RCL2	36 02	
055	1	01		111	RCL1	36 01	
056	6	06		112	.	-62	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

$$\Delta X_0 = (1.3 - 1.6 e^{-0.0674 X_0}) (30.3 W - 0.234 W^{-0.7345})$$

compute C<sub>0</sub> from

$$C_0 = 0.322 e^{-0.0229 (X_0 + \Delta X_0)} W^{(0.05 - 0.0004 X_0)}$$

C-4

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	0	00					
114	0	00					
115	0	00					
116	4	04					
117	6	06					
118	DHS	-22					
119	x	-35					
120	1	01					
121	.	-62					
122	0	00					
123	3	03					
124	+	-55					
125	yx	31					
126	x	-35					
127	RCL1	36 01	special condition for modifying C <sub>0</sub>				
128	X#0?	16-42					
129	GT03	22 03					
130	XZY	-41	if X <sub>0</sub> = 0				
131	.	-62	and				
132	1	01					
133	7	07					
134	XZY?	16-35	.0011 < C <sub>0</sub> < .17				
135	GT03	22 03	than				
136	XZY	-41	C <sub>0</sub> ← .9C <sub>0</sub>				
137	.	-62					
138	0	00					
139	0	00					
140	1	01					
141	1	01					
142	XZY?	16-34					
143	GT03	22 03					
144	XZY	-41					
145	.	-62					
146	9	09					
147	x	-35					
148	GT04	22 04					
149	LBL3	21 03	get C <sub>0</sub> in R <sub>x</sub>				
150	R4	-31	save C <sub>0</sub> in R <sub>0</sub>				
151	LBL4	21 04					
152	ST00	35 00	print code 1				
153	SPC	16-11	and C <sub>0</sub>				
154	1	01					
155	PRTX	-14					
156	RCL0	36 00					
157	PRTX	-14					
158	RTN	24					
159	R/S	51					

LABELS					FLAGS	SET STATUS			
A	B	C	D	E	0	FLAGS		TRIG	DISP
a	b	c	d	e	1	ON OFF			
0	1	2	3	4	2	0	<input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1	<input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2	<input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3	<input type="checkbox"/> <input type="checkbox"/>		n. <input type="checkbox"/>

CARD 0-2 Co, WITH INTERIOR PARTITIONS

C-5

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*BLA	21 11		057	3	03	
002	STOE	35 00	input $C_0$	058	CHS	-00	
003	RTN	24		059	x	-35	
004	*LBLE	21 12		060	e <sup>x</sup>	37	
005	STOE	35 15	input $X_i$	061	.	-52	
006	RTN	24		062	5	05	
007	*LBLE	21 13	start computing	063	3	03	
008	RCLC	36 15	$B_i' = C_0$	064	8	08	
009	2	02	if $X_i \leq 20$	065	5	05	
010	0	00	compute	066	2	02	
011	RCLC	36 15		067	x	-35	
012	X>Y?	16-34		068	*LBL1	21 01	
013	GT02	22 02		069	STOD	35 14	
014	.	-52		070	RCL0	36 00	
015	0	00		071	x	-35	
016	3	03		072	SPC	16-11	
017	7	07		073	1	01	
018	CHS	-22		074	PRTX	-14	
019	x	-35		075	R↓	-31	
020	e <sup>x</sup>	37		076	PRTX	-14	
021	.	-52		077	RTN	24	
022	9	09		078	0	00	
023	6	06		079	0	00	
024	8	08		080	0	00	
025	5	05		081	0	00	
026	x	-35		082	0	00	
027	GT01	22 01		083	0	00	
028	*LBL2	21 02		084	0	00	
029	9	09		085	0	00	
030	0	00		086	0	00	
031	RCLC	36 15		087	0	00	
032	X>Y?	16-34		088	0	00	
033	GT03	22 03		089	0	00	
034	.	-52		090	0	00	
035	0	00		091	0	00	
036	2	02		092	0	00	
037	7	07		093	0	00	
038	2	02		094	0	00	
039	3	03		095	0	00	
040	CHS	-22		096	0	00	
041	x	-35		097	0	00	
042	e <sup>x</sup>	37		098	0	00	
043	.	-52		099	0	00	
044	0	00		100	0	00	
045	0	00		101	0	00	
046	0	00		102	0	00	
047	1	01		103	0	00	
048	x	-35		104	0	00	
049	GT01	22 01		105	0	00	
050	*LBL3	21 03		106	0	00	
051	RCLC	36 15		107	0	00	
052	.	-52		108	0	00	
053	0	00		109	0	00	
054	2	02		110	0	00	
055	3	03		111	0	00	
056	0	00		112	0	00	

$B_i' = .53852e^{-0.0370X_i}$

store  $B_i'$  in  $R_0$   
compute  
 $B_i' = C_0$   
print code 1  
and  
 $B_i' = C_0$

if  
 $20 < X_i \leq 90$   
compute

$B_i' = .800e^{-0.02723X_i}$

if  $X_i > 90$   
compute

Blank steps to require all cards  
to be read on both sides

REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



[illegible]

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL4	21 16 11	input $X_i$ W L	057	R+	-31	
002	STOB	35 12		058	P+S	16-51	get primary register
003	=	-24	save $e = \frac{W}{L}$	059	GSB4	23 16 14	compute $B_i(K_i)$
004	STOA	35 11		060	P+S	16-51	get secondary register
005	R+	-31		061	2	02	$R_{57} \leftarrow w/2$
006	*LBL4	21 16 14	compute $B_i$	062	ST=7	35-24 07	
007	1	01		063	RCL7	36 07	compute $A_z$
008	1	01	if $X_i > 110$	064	RCL8	36 08	
009	0	00		065	+	-55	
010	X=Y	-41	go to LBL1	066	RCL9	36 09	
011	X>Y?	16-34		067	=	-24	
012	GT01	22 01		068	DEG	16-21	
013	.	-62	if $X_i \leq 110$	069	TAN	16 42	
014	0	00	compute	070	RCL8	36 08	
015	2	02		071	RCL7	36 07	
016	3	03		072	-	-45	
017	9	09		073	RCL9	36 09	
018	CHS	-22	$B_i = 1.003e - 0.239X_i$	074	=	-24	
019	x	-35		075	TAN	16 42	
020	e*	33		076	-	-45	
021	1	01		077	3	03	
022	.	-62		078	6	06	
023	0	00		079	0	00	
024	0	00		080	=	-24	
025	3	03		081	P+S	16-51	get primary register
026	x	-35		082	STX2	35-35 02	$R_2 \leftarrow B_i \cdot A_z$
027	1	01	if $B_i > 1$	083	P+S	16-51	get secondary register
028	X=Y	-41	then	084	RCL9	36 09	if
029	X>Y?	16-34	$B_i \leftarrow 1$	085	RCL8	36 08	$x + w/2 \leq y$
030	1	01		086	RCL7	36 07	go to LBL3
031	GT02	22 02		087	+	-55	
032	*LBL1	21 01	if $X_i > 110$	088	X=Y?	16-35	
033	.	-62	compute	089	GT03	22 03	
034	0	00		090	2	02	else, if $x + w/2 > y$
035	2	02		091	x	-35	$L = 2(x + w/2)$
036	1	01		092	STOB	35 12	$w = 2y$
037	1	01		093	X=Y	-41	$e = \frac{w}{L}$
038	CHS	-22	$B_i = 1.7405e - 0.211X_i$	094	2	02	
039	x	-35		095	x	-35	
040	e*	33		096	X=Y	-41	
041	.	-62		097	=	-24	
042	7	07		098	GT04	22 04	if $x + w/2 \leq y$
043	4	04		099	*LBL3	21 03	$L = 2\sqrt{x^2 + y^2}$
044	0	00		100	RCL8	36 08	
045	5	05		101	X^2	57	
046	x	-35		102	RCL9	36 09	
047	*LBL2	21 02	save $B_i$ in $R_2$	103	X^2	57	
048	STO2	35 02		104	+	-55	
049	RTN	24		105	FX	54	
050	*LBL4	21 11	input $X_i$ x y w	106	2	02	
051	P+S	16-51	get secondary register	107	x	-35	$e = 1$
052	STO7	35 07	save w	108	STOB	35 12	
053	R+	-31	save y	109	1	01	$e \rightarrow R_4$
054	STO9	35 09	save x	110	*LBL4	21 04	
055	R+	-31		111	STOA	35 11	get primary register
056	STOB	35 08		112	P+S	16-51	

$$A_z = \frac{\tan^{-1}(x + w/2)}{y} - \frac{\tan^{-1}(x - w/2)}{y}$$

$$L = 2(x + \frac{w}{2})$$

$$w = 2y$$

$$e = \frac{w}{L}$$

$$L = 2\sqrt{x^2 + y^2}$$

REGISTERS									
0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

# CARD GM-1 (Continued)

C-8

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	RTN	24	return	169	X=Y	-41	
114	LBL6	21 12	input H Z, Z <sub>2</sub> Z <sub>3</sub>	170	÷	-24	where
115	STO5	35 09	save Z <sub>3</sub>	171	RAD	16-22	$e = W/L$
116	R4	-31		172	TAN	16 43	$a = Z/L$
117	STO6	35 08	save Z <sub>2</sub>	173	2	02	
118	R4	-31		174	x	-35	
119	STO7	35 07	save Z <sub>1</sub>	175	PI	16-24	
120	R4	-31		176	÷	-24	
121	STOE	35 15		177	*LBL6	21 06	if Flag 1 set
122	9	09	set indirect register	178	F1?	16 23 01	W is negative
123	STO1	35 46	counter to R <sub>9</sub>	179	CHS	-22	save W
124	RCL6	36 08	R <sub>50</sub> ← W (Z <sub>2</sub> )	180	STO1	35 45	return
125	GSBe	23 16 15	(W <sub>01</sub> OR W <sub>02</sub> )	181	RTN	24	input P <sub>a</sub> on A <sub>p</sub>
126	RCL7	36 07	(W <sub>02</sub> OR W <sub>01</sub> )	182	*BLD	21 14	in R <sub>5</sub>
127	GSBe	23 16 15	R <sub>51</sub> ← W (Z <sub>1</sub> )	183	STO5	35 05	
128	RCL9	36 09	R <sub>52</sub> ← W (Z <sub>3</sub> -Z <sub>2</sub> )	184	RTN	24	input X <sub>e</sub> X <sub>a</sub>
129	RCL6	36 08	(W <sub>02</sub> )	185	*BLC	21 13	R <sub>0</sub> ← X <sub>a</sub>
130	-	-45		186	STOD	35 14	R <sub>c</sub> ← X <sub>e</sub>
131	GSBe	23 16 15	R <sub>53</sub> ← W (Z <sub>3</sub> -Z <sub>1</sub> )	187	R4	-31	input W <sub>c</sub>
132	RCL9	36 09	(W <sub>01</sub> )	188	STOC	35 13	save W <sub>c</sub>
133	RCL7	36 07		189	RTN	24	R <sub>x</sub> ← 2W <sub>c</sub>
134	-	-45		190	*BLE	21 15	R <sub>y</sub> ← 2W <sub>c</sub>
135	GSBe	23 16 15	R <sub>54</sub> ← W (Z <sub>3</sub> )	191	STO1	35 01	R <sub>z</sub> ← 2W <sub>c</sub>
136	RCL9	36 09	(W <sub>03</sub> )	192	2	02	save e in R <sub>4</sub>
137	GSBe	23 16 15	get secondary register	193	x	-35	
138	P=S	16-51	initialize	194	ENT↑	-21	
139	1	01	R <sub>55</sub> ← 1(W <sub>0</sub> )	195	ENT↑	-21	
140	STO5	35 05	R <sub>56</sub> ← W <sub>0c</sub>	196	RCLA	36 11	
141	STO6	35 06	get primary register	197	STO4	35 04	
142	P=S	16-51	return	198	RCLB	36 12	
143	RTN	24	compute W [Z]	199	x	-35	
144	*LBL6	21 16 15	increment I register	200	+	-55	
145	ISZ1	16 26 46	clear Flag 1	201	X=Y	-41	
146	CF1	16 22 01	if Z < 0	202	RCLB	36 12	
147	X<0?	16-45	set Flag 1	203	+	-55	
148	SF1	16 21 01	R <sub>x</sub> ← 1Z1	204	STOB	35 12	
149	ABS	16 31	if Z ≠ 0	205	÷	-24	
150	X#0?	16-42	go to LBL5	206	STOA	35 11	
151	STO5	22 05	if Z = 0, W = 1	207	RCLC	36 15	
152	1	01	go to LBL6	208	GSBe	23 16 15	
153	STO6	22 06	compute W	209	RCLC	36 15	
154	*LBL5	21 05		210	RCL9	36 09	
155	RCLB	36 12		211	+	-55	
156	÷	-24		212	GSBe	23 16 15	
157	2	02		213	RCL4	36 04	
158	x	-35		214	STOA	35 11	
159	ENT↑	-21		215	SPC	16-11	
160	X²	53		216	2	02	
161	RCLA	36 11		217	PRTX	14	
162	X²	53		218	RTN	24	
163	+	-55		219	R/S	51	
164	1	01					
165	+	-55					
166	JX	54					
167	x	-35					
168	RCLA	36 11					

$$W = \frac{2}{\pi} \tan^{-1} \left( \frac{e}{2\sqrt{4+e^2}} \right)$$

where  
 $e = W/L$   
 $a = Z/L$

if Flag 1 set  
W is negative  
save W  
return  
input P<sub>a</sub> on A<sub>p</sub>  
in R<sub>5</sub>

input X<sub>e</sub> X<sub>a</sub>  
R<sub>0</sub> ← X<sub>a</sub>  
R<sub>c</sub> ← X<sub>e</sub>

input W<sub>c</sub>  
save W<sub>c</sub>  
R<sub>x</sub> ← 2W<sub>c</sub>  
R<sub>y</sub> ← 2W<sub>c</sub>  
R<sub>z</sub> ← 2W<sub>c</sub>

save e in R<sub>4</sub>

R<sub>B</sub> ← 2W<sub>c</sub> + L

R<sub>A</sub> ←  $\frac{2W_c + W}{2W_c + L}$

R<sub>0</sub> ← L'  
R<sub>A</sub> ← e'

R<sub>55</sub> ← W (H)  
R<sub>56</sub> ← W (H + Z<sub>3</sub>)

W<sub>03</sub>

restore R<sub>A</sub>  
with e

display  
program 2  
request

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n



CARD GM-2 -Cg, DETAIL WALL PORTION

C-9

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	continue	057	P2S	16-51	get secondary register
002	RCLC	36 13	compute Sw (X <sub>e</sub> )	058	RCL3	36 03	compute G <sub>c</sub>
003	GSBd	23 16 14	save in R <sub>3</sub>	059	GSBb	23 16 12	
004	STO3	35 03		060	STO3	35 03	
005	RCLD	36 14	compute Sw (X <sub>a</sub> )	061	RCL2	36 02	
006	GSBd	23 16 14	save in R <sub>4</sub>	062	GSBb	23 16 12	
007	STO4	35 04		063	ST-3	35-45 03	
008	RCLA	36 11	compute E (e)	064	RCL4	36 04	
009	ENT1	-21		065	GSBa	23 16 11	
010	ENT1	-21		066	.	-52	
011	1	01		067	1	01	
012	+	-55		068	X=Y	-41	
013	X=Y	-41		069	-	-45	
014	X <sup>2</sup>	53		070	STX3	35-35 03	
015	1	01		071	*LBL4	21 04	
016	+	-55		072	RCL6	36 00	
017	JX	54		073	X<0?	16-45	
018	=	-24		074	GT01	22 01	
019	STO1	35 46	store in R <sub>1</sub>	075	GSBb	23 16 12	
020	P2S	16-51	get secondary register	076	ST+8	35-55 08	
021	RCL2	36 02	if ω <sub>2</sub> > ω <sub>2</sub>	077	5	05	
022	RCL6	36 06	go to LBL 3	078	=	-24	
023	X>Y?	16-34	no M.S. effect	079	ST+7	35-55 07	
024	GT03	22 03	ω <sub>2</sub> ← ω <sub>3</sub>	080	RCL1	36 01	
025	STO2	35 02	if ω <sub>2</sub> > ω <sub>1</sub>	081	X<0?	16-45	
026	RCL3	36 03	go to LBL 3	082	GT02	22 02	
027	X=Y?	-41	OK	083	GSBb	23 16 12	
028	X>Y?	16-34	ω <sub>1</sub> ← ω <sub>3</sub>	084	ST-8	35-45 08	
029	GT03	22 03	initialize	085	5	05	
030	STO3	35 03	Air, scatter	086	=	-24	
031	*LBL3	21 03	and direct	087	ST-7	35-45 07	
032	0	00	get primary register	088	GT09	22 09	
033	STO2	35 02	if X <sub>a</sub> ≠ 0	089	*LBL2	21 02	
034	STO8	35 08	no aperture	090	CHS	-22	
035	STO9	35 09	if 3+Z <sub>1</sub> < 0	091	GSBb	23 16 12	
036	P2S	16-51	story below	092	ST+8	35-55 08	
037	RCLD	36 14	go to LBL e	093	GT08	22 08	
038	X<0?	16-42	if Z <sub>3</sub> -Z <sub>2</sub> < 0	094	*LBL1	21 01	
039	GT0e	22 16 15	story above	095	RCL1	36 01	
040	3	03	go to LBL e	096	CHS	-22	
041	RCL7	36 07	G <sub>c</sub> ≠ 0 go to LBL c	097	GSBb	23 16 12	
042	+	55	G <sub>c</sub> = 0	098	ST+8	35-55 08	
043	X<0?	16-45	get secondary register	099	RCL8	36 08	
044	GT0e	22 16 15	R <sub>3</sub> ← 0 (G <sub>c</sub> )	100	CHS	-22	
045	RCL9	36 09	compute G <sub>g</sub>	101	GSBb	23 16 12	
046	RCL8	36 08		102	ST-8	35-45 08	
047		45		103	GT08	22 08	
048	X<0?	16-45		104	*LBL9	21 09	
049	GT0e	22 16 15		105	P2S	16-51	
050	GT0c	22 16 13		106	SPC	16-11	
051	*LBL e	21 16 15		107	4	04	
052	0	00		108	PRTX	14	
053	P2S	16-51		109	RTN	24	
054	STO3	35 03		110	*LBL8	21 08	
055	GT04	22 04		111	P2S	16-51	
056	*LBL c	21 16 13		112	SPC	16-11	

$$G_c = 5 [G_c(\omega_1) - G_c(\omega_2)] \times [1 - G_c(\omega_2)]$$

$$E = \frac{e^{x_1}}{\sqrt{e^{x_2}}}$$

$R_{33} \leftarrow G_c$   
 if  $R_{30} < 0$   
 then case 3  
 $\omega_{L3}$   
 go to LBL 1  
 else case 1 or 2  
 add  $G_s(\omega_{L1})$  to  $R_{33}$   
 add  $G_a(\omega_{L1})$   
 to  $R_{37}$  (air)  
 if  $R_{31} < 0$   
 then case 2 or 3  
 go to LBL 2  
 else case 1, subtract  
 $G_s(\omega_{L2})$  from  $R_{33}$   
 subtract  
 $G_a(\omega_{L2})$   
 from  $R_{37}$   
 case 2 or 3  
 $|\omega_{L1}|$   
 add  $G_s(\omega_{L1})$   
 to  $R_{33}$   
 Case 3  
 add  $G_s(\omega_{L1})$   
 to  $R_{33}$   
 subtract  
 $G_s(\omega_{L2})$   
 from  $R_{33}$   
 Case 1 end  
 get primary register  
 display  
 program 4 request  
 no direct  
 case 1 and 2 end  
 get primary register

LABELS					FLAGS	SET STATUS		
B	C	D	E		0	FLAGS	TRIG	DISP
b	c	d	e		1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n

# CARD GM-2 (Continued)

C-10

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	3	03	display program 3	169	SSBa 23 16 11		get $G_a$
114	PRTX	-14	request	170	5	05	
115	RTN	24	needs direct	171	X	-35	$G_s = 5 G_a$
116	*LBLa 21 16 11		compute $G_a$	172	RTN	24	
117	STO6	35 05	save $\omega$	173	*LBLd 21 16 14		compute $S_{ur}$
118	.	-62	if $\omega \leq .7$	174	STOI	35 45	save X
119	7	07		175	3	03	
120	RCL6	36 06	go to LBL 5	176	0	00	$R_o \leftarrow 30$
121	X&Y?	16-35		177	STO0	35 00	
122	GT05	22 05		178	3	03	if $X > 35$
123	.	-62	if	179	5	05	go to LBL 0
124	8	08	$.7 < \omega < .05$	180	RCLI	36 45	USE 30
125	5	05		181	X&Y?	16-34	
126	X&Y?	16-34	go to LBL 6	182	STO0	22 00	
127	GT06	22 06		183	4	04	else
128	.	-62	for $.05 \geq \omega$	184	ST+0	35-55 00	$R_o \leftarrow 34$
129	2	02	compute $G_a$	185	RCLI	36 46	if $X \geq 13$
130	2	02		186	1	01	go to LBL 0
131	2	02		187	3	03	
132	ENT↑	-21		188	X&Y?	16-35	USE 34
133	.	-62		189	STO0	22 00	
134	9	09		190	3	03	$R_o \leftarrow 37$
135	8	08		191	ST+0	35-55 00	USE 37
136	8	08		192	*LBL0	21 00	
137	*LBL7 21 07			193	RCLI	36 46	
138	ENT↑	-21		194	RCLI	36 46	
139	1	01		195	RCL0	36 00	
140	RCL6	36 06		196	+	-55	
141	-	-45		197	÷	-24	
142	X&Y	-41		198	RTN	24	
143	YX	31		199	R/S	51	
144	X	-35					
145	RTN	24					
146	*LBL5 21 05		for $\omega \leq .7$				
147	.	-62	compute $G_a$				
148	1	01					
149	0	00					
150	2	02					
151	ENT↑	-21					
152	.	-62					
153	4	04					
154	6	06					
155	5	05					
156	GT07	22 07					
157	*LBL6 21 06						
158	.	-62	for				
159	1	01	$.7 < \omega < .05$				
160	4	04	compute				
161	8	08					
162	ENT↑	-21					
163	.	-62					
164	7	07					
165	7	07					
166	9	09					
167	GT07	22 07					
168	*LBLb 21 16 12						

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



## CARD GM-3 Cg, DETAIL WALL PORTION

C-11

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	RCLC	36 15	
002	P=S	16-51	get secondary register	058	.	-62	
003	RCL1	36 01	if $\omega_{L1} > 0$	059	2	02	
004	X>0?	16-44	no direct	060	3	03	
005	GT06	22 06	go to LBL 6	061	0	00	
006	CHS	-22	$ \omega_{L1} $	062	3	03	
007	ST01	35 01	save in R <sub>S1</sub>	063	Y*	31	
008	RCL5	36 05	if $\omega_c \leq \omega_{L1}$	064	.	-62	
009	X=Y?	16-35	complete MS of direct	065	1	01	
010	GT06	22 06	go to LBL 6	066	5	05	
011	RCL0	36 00	if $\omega_{L2} < 0$	067	8	08	
012	X<0?	16-45	go to LBL 4	068	4	04	
013	GT04	22 04	else use	069	X	-35	
014	RCL5	36 05	$\omega_c$ as $\omega_{L2}$	070	1	01	
015	ST00	35 00	$\omega_{L2} \leftarrow \omega_c$	071	RCL6	36 06	
016	GT05	22 05	$ \omega_{L2} $	072	.	-45	
017	*LBL4	21 04		073	LN	32	
018	CHS	-22		074	X	-35	
019	ST00	35 00	save in R <sub>S0</sub>	075	+	-55	
020	RCL5	36 05	if $\omega_c > \omega_{L2}$	076	RCLC	36 15	
021	X=Y?	16-34	go to LBL 5	077	3	03	
022	GT05	22 05	else use	078	X=Y?	16-32	
023	ST00	35 00	$\omega_c$ for $\omega_{L2}$	079	GT02	22 02	
024	*LBL5	21 05	add $G_d(\omega)$	080	R+	-31	
025	RCL1	36 01	to R <sub>S9</sub>	081	R+	-31	
026	ESBe	23 16 15		082	X<0?	16-45	
027	ST+9	35-55 09	subtract	083	0	00	
028	RCL0	36 00	$G_d(\omega_{L2})$	084	RTN	24	
029	ESBe	23 16 15	from R <sub>S9</sub>	085	*LBL2	21 02	
030	ST-9	35-45 09	finished	086	R+	-31	
031	*LBL6	21 06		087	R+	-31	
032	P=S	16-51	get primary registers	088	.	-62	
033	SPC	16-11	display	089	2	02	
034	4	04	program 4	090	5	05	
035	PRTX	-14	request	091	X=Y	-41	
036	RTN	24		092	X=Y?	16-34	
037	*LBLC	21 16 15	compute $G_d$	093	RTN	24	
038	ST06	35 06	save $\omega$	094	RCLC	36 15	
039	1	01	if $\omega = 1$	095	.	-62	
040	.	-45		096	3	03	
041	X=0?	16-43	$G_d = 0$	097	2	02	
042	RTN	24		098	2	02	
043	RCLC	36 15	compute	099	6	06	
044	.	-62	as	100	Y*	31	
045	0	00	follows	101	.	-62	
046	1	01		102	0	00	
047	9	09		103	1	01	
048	3	03		104	4	04	
049	CHS	-22		105	0	00	
050	Y*	31		106	4	04	
051	.	-62		107	CHS	-22	
052	9	09		108	X	-35	
053	2	02		109	RCLC	36 15	
054	3	03		110	.	-62	
055	4	04		111	4	04	
056	X	-35		112	7	07	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

$G_d = 1.9234H^{-0.093} \times 1.544 \cdot 2.301 \log(1-\omega)$

if  $H \neq 3$   
go to LBL 2  
else if  $H=3$   
get back  $G_d$   
if  $G_d < 0$   
 $G_d = 0$   
return  $G_d$   
for  $H \neq 3$   
get back  $G_d$  calc.  
if  $G_d > .25$   
return  $G_d$

else compute  
 $G_d = .01404H^{.3226} \times 0.634H \cdot 4.723 \log \omega$



CARD GM-3 (Continued)

C-12

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	2	02		169	7	07	
114	3	03		170	7	07	
115	CHS	-22		171	CHS	-22	
116	Y*	31		172	x	-35	
117	8	08		173	RCL6	36 06	
118	.	-62		174	LN	32	
119	6	06		175	x	-35	
120	3	03		176	+	-55	
121	CHS	-22		177	.	-62	else
122	x	-35		178	0	00	return
123	RCL6	36 06		179	0	00	
124	LN	32		180	6	06	
125	x	-35		181	X>Y?	16-34	
126	+	-55		182	GT03	22 03	
127	.	-62		183	R4	-31	
128	0	00		184	RTN	24	
129	4	04		185	*LBL3	21 03	
130	X=Y	-41		186	1	01	
131	X>Y?	16-34		187	RCL6	36 06	
132	RTN	24		188	-	-45	
133	RCL6	36 15		189	.	-62	
134	2	02		190	3	03	
135	0	00		191	x	-35	
136	X=Y?	16-35		192	RTN	24	
137	GT01	22 01		193	R/S	51	
138	R4	-31					
139	R4	-31					
140	RTN	24					
141	*LBL1	21 01					
142	RCL6	36 15					
143	.	-62					
144	4	04					
145	5	05					
146	9	09					
147	7	07					
148	CHS	-22					
149	Y*	31					
150	.	-62					
151	0	00					
152	9	09					
153	3	03					
154	8	08					
155	9	09					
156	CHS	-22					
157	x	-35					
158	RCL6	36 15					
159	.	-62					
160	6	06					
161	9	09					
162	4	04					
163	4	04					
164	CHS	-22					
165	Y*	31					
166	1	01					
167	2	02					
168	.	-62					

Calculating  $G_d$

if  $G_d > .04$

Ok return

else  
if  $20 \leq H$

go to LBL 1

else return

$G_d$  calculated

Compute

$G_d = .09389H^{-.4597} - 12.77H^{-.6944 \log H}$

else  
return  
 $G_d$   
compute  
 $G_d = (1 - \phi)^{.3}$

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n _____

CARD GM-4 Cg, DETAIL WALL PORTION

C-12

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL4	21 11	$R_0 \leftarrow 0$	057	-	-45	$(1 - S_w(X_e))$
002	0	00	initialize	058	x	-35	$x(\text{Direct} \cdot Be(X_e))$
003	ST00	35 00		059	RCL5	36 05	$x(P_a) \rightarrow R_1$
004	1	01		060	x	-35	
005	RCL5	36 05	$R_6 \leftarrow 1 - P_a$	061	ST+0	35-55 00	get secondary register
006	-	-45		062	P2S	16-51	
007	ST06	35 06	get secondary registers	063	RCL3	36 03	$G_c \cdot Be(X_e)$
008	P2S	16-51	save $w_{uz}$ in $R_{s4}$	064	RCL1	36 01	
009	RCL1	36 01		065	x	-35	get primary register
010	ST04	35 04	$R_{s0} \leftarrow Be(X_e)$	066	P2S	16-51	add
011	RCLC	36 13		067	RCL5	36 05	$G_c \cdot Be(X_e) \cdot P_a \rightarrow R_0$
012	GSCBc	23 16 13	$R_{s1} \leftarrow Be(X_e)$	068	x	-35	get secondary register
013	ST00	35 00		069	ST+0	35-55 00	
014	RCLD	36 14		070	P2S	16-51	on stack $\{x\}$
015	GSCBc	23 16 13	$A_{11} \leftarrow Be(X_e)$	071	1	01	get primary register
016	ST01	35 01		072	RCL5	36 05	if $w_c = 1$ no M.S.
017	RCL7	36 07	$A_{12} \leftarrow Be(X_e)$	073	P2S	16-51	go to LBL3
018	RCL1	36 01		074	X=Y?	16-33	multiply
019	x	-35	$A_{12} \leftarrow Be(X_e)$	075	GT03	22 03	$R_0$ by $B_i - A_z$
020	RCL7	36 07	get primary registers	076	RCL2	36 02	display
021	RCL8	36 08	add	077	STx0	35-35 00	Program 5 request
022	x	-35	$(1 - S_w(X_e))$	078	SPC	16-11	need M.S.
023	P2S	16-51	$x(A_{12} - Be(X_e))$	079	5	05	no M.S.
024	1	01	$x(1 - P_a) \rightarrow R_0$	080	PRTX	-14	get secondary register
025	RCL3	36 03		081	RTN	24	
026	-	-45		082	*LBL3	21 03	$Scat_c \leftarrow Be(X_e)$
027	x	-35	add	083	P2S	16-51	$Scat_c \leftarrow Be(X_e)$
028	RCL6	36 06	$(1 - S_w(X_e))$	084	RCL8	36 08	get primary register
029	x	-35	$x(A_{12} - Be(X_e))$	085	RCL1	36 01	add
030	ST+0	35-55 00	$x(P_a) \rightarrow R_1$	086	x	-35	$(Scat_c \cdot Be(X_e))$
031	R4	-31	get secondary registers	087	RCL8	36 08	$x(E \cdot S_w(X_e))$
032	1	01		088	RCL0	36 00	$x(1 - P_a) \rightarrow R_0$
033	RCL4	36 04		089	x	-35	add
034	-	-45		090	P2S	16-51	$(Scat_c \cdot Be(X_e))$
035	x	-35		091	RCL1	36 01	$x(E \cdot S_w(X_e))$
036	RCL5	36 05		092	x	-35	$x(P_a) \rightarrow R_0$
037	x	-35		093	RCL3	36 03	
038	ST+0	35-55 00		094	x	-35	
039	P2S	16-51		095	RCL6	36 06	
040	RCL9	36 09		096	x	-35	
041	RCL1	36 01	Direct $\leftarrow Be(X_e)$	097	ST+0	35-55 00	
042	x	-35		098	R4	-31	
043	RCL9	36 09		099	RCL1	36 01	
044	RCL0	36 00	Direct $\leftarrow Be(X_e)$	100	x	-35	
045	x	-35		101	RCL4	36 04	
046	P2S	16-51	get primary register	102	x	-35	
047	1	01	add	103	RCL5	36 05	
048	RCL3	36 03	$(1 - S_w(X_e))$	104	x	-35	
049	-	-45	$x(\text{Direct} \cdot Be(X_e))$	105	ST+0	35-55 00	
050	x	-35	$x(1 - P_a) \rightarrow R_0$	106	RCL2	36 02	multiply
051	RCL6	36 06		107	STx0	35-35 00	$R_0$ by $B_i - A_z$
052	x	-35		108	SPC	16-11	display
053	ST+0	35-55 00		109	2	02	Code 2
054	R4	-31	add	110	PRTX	-14	and $C_g(R_0)$
055	1	01		111	RCL0	36 00	
056	RCL4	36 04		112	PRTX	-14	

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n_____

# CARD GM-4 (Continued)

C-14

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	RTN	24		169	.	-62	
114	*LBLc 21 16 17			170	0	00	
115	ST06	35 05		171	0	00	
116	.	-62		172	0	00	
117	2	02		173	5	05	
118	CHS	-22		174	4	04	
119	RCLc	36 15		175	CHS	-22	
120	x	-35		176	RCL6	36 06	
121	e <sup>x</sup>	33		177	x	-35	
122	.	-62		178	.	-62	
123	4	04		179	2	02	
124	x	-35		180	0	00	
125	.	-62		181	+	-55	
126	0	00		182	x	-35	
127	3	03		183	+	-55	
128	CHS	-22		184	.	-62	
129	RCLc	36 15		185	0	00	
130	x	-35		186	2	02	
131	e <sup>x</sup>	33		187	0	00	
132	.	-62		188	9	09	
133	0	00		189	CHS	-22	
134	0	00		190	RCL6	36 06	
135	0	00		191	x	-35	
136	6	06		192	e <sup>x</sup>	33	
137	6	06		193	.	-62	
138	RCL6	36 06		194	7	07	
139	x	-35		195	x	-35	
140	.	-62		196	.	-62	
141	2	02		197	0	00	
142	3	03		198	4	04	
143	2	02		199	0	00	
144	+	-55		200	0	00	
145	x	-35		201	CHS	-22	
146	+	-55		202	RCL6	36 06	
147	.	-62		203	x	-35	
148	0	00		204	e <sup>x</sup>	33	
149	0	00		205	.	-62	
150	9	09		206	3	03	
151	CHS	-22		207	x	-35	
152	RCLc	36 15		208	+	-55	
153	x	-35		209	x	-35	
154	e <sup>x</sup>	33		210	1	01	
155	.	-62		211	X=Y	-41	
156	3	03		212	X=Y?	15-34	
157	x	-35		213	1	01	
158	+	-55		214	RTN	24	
159	.	-62		215	0	00	
160	0	00		216	0	00	
161	0	00		217	R/S	51	
162	2	02					
163	2	02					
164	0	00					
165	CHS	-22					
166	RCLc	36 15					
167	x	-35					
168	e <sup>x</sup>	33					

$$B_e = [3e^{-0.0408x} + 17e^{-0.0209x}] [(28 - 0.00054x)e^{-0.0228H} + 3e^{-0.009H} + (232 + 0.0006x)e^{-0.03H} + 4e^{-0.2H}]$$

computing  $B_e$

if  $B_e > 1$   
 then  
 $B_e = 1$

REGISTERS									
0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	compute	057	2	02	display
002	RCL1	36 01		058	PRTX	-14	code 2
003	RCL5	36 15		059	RCL0	36 00	and Cg
004	=	-24		060	PRTX	-14	
005	RAD	16-22		061	RTN	24	
006	TAN	16 43		062	*LBLA	21 11	compute B <sub>s</sub>
007	2	02		063	RCL6	36 06	2ω <sub>s</sub>
008	x	-35		064	RCL5	36 05	if X <sub>e</sub> = 0
009	PI	16-24		065	X=0?	16-43	go to LBL 1
010	=	-24		066	STO1	22 01	
011	.	-62		067	.	-62	for X <sub>e</sub> > 0
012	8	08	on stack { .B } 2ω <sub>s</sub>	068	2	02	compute
013	X=Y	-41		069	1	01	
014	P=S	16-51	get secondary registers	070	5	05	
015	STO6	35 06	R <sub>56</sub> ← 2ω <sub>s</sub>	071	7	07	
016	X>Y?	16-34	if 2ω <sub>s</sub> > .8	072	YX	31	
017	GT09	22 09	go to LBL9	073	.	-62	
018	RCL0	36 17	save X <sub>e</sub>	074	9	09	
019	STO5	35 05	in R <sub>55</sub>	075	7	07	
020	GSB4	23 16 11	R <sub>50</sub> ← B <sub>s</sub>	076	6	06	
021	STO0	35 00	save X <sub>a</sub>	077	4	04	
022	RCL0	36 14	in R <sub>55</sub>	078	x	-35	
023	STO5	35 05		079	YX	31	
024	GSB4	23 16 11	R <sub>51</sub> ← B <sub>s</sub>	080	.	-62	
025	STO1	35 01	go to LBL0	081	2	02	
026	GT00	22 00		082	7	07	
027	*LBL9	21 09	compute F <sub>s</sub>	083	9	09	
028	GSB6	23 16 12	R <sub>0</sub> ← B <sub>e</sub> (X <sub>a</sub> ) · F <sub>s</sub>	084	x	-35	
029	STX0	35-35 00	R <sub>1</sub> ← B <sub>e</sub> (X <sub>e</sub> ) · F <sub>s</sub>	085	RCL5	36 05	
030	STX1	35-35 01		086	.	-62	
031	*LBL0	21 00	(scat - E)	087	0	00	
032	RCL0	36 08	x (B <sub>s</sub> (X <sub>a</sub> ))	088	2	02	
033	RCL1	36 46		089	2	02	
034	x	-35		090	3	03	
035	RCL1	36 01		091	4	04	
036	x	-35		092	2	02	
037	RCL8	36 08	(scat - E)	093	CHS	-22	
038	RCL1	36 46	x (B <sub>s</sub> (X <sub>a</sub> ))	094	x	-35	
039	x	-35		095	e <sup>x</sup>	33	
040	RCL0	36 00		096	x	-35	
041	x	-35		097	STO2	22 02	
042	P=S	16-51	get primary registers	098	*LBL1	21 01	for X <sub>e</sub> = 0
043	RCL3	36 03	(scat - E)	099	RCL6	36 06	compute
044	x	-35	x (B <sub>s</sub> (X <sub>a</sub> ))	100	1	01	
045	RCL6	36 06	x (Sur(X <sub>a</sub> ) · (1 - P <sub>a</sub> ))	101	.	-62	
046	x	-35	(scat - E)	102	0	00	
047	X=Y	-41	x (B <sub>s</sub> (X <sub>a</sub> ))	103	5	05	
048	RCL4	36 04		104	YX	31	
049	x	-35	(Sw(X <sub>a</sub> ) · (P <sub>a</sub> ))	105	.	-62	
050	RCL5	36 05	total	106	2	02	
051	x	-35	scat - B <sub>i</sub> · A <sub>2</sub> added	107	3	03	
052	+	-55	to total in R <sub>0</sub>	108	2	02	
053	RCL2	36 02		109	3	03	
054	x	-35		110	x	-35	
055	ST+0	35-55 00		111	*LBL2	21 02	save B <sub>s</sub> in R <sub>52</sub>
056	SPC	16-11		112	STO2	35 02	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

CARD GM-5 (Continued)

C-16

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	.	-62		169	4	04	if
114	0	00	if .002 > B <sub>s</sub>	170	X=Y	-41	2ω <sub>s</sub> ≤ .84
115	0	00		171	X=Y?	16-35	or
116	2	02	go to LBL 3	172	GT00	22 16 13	H ≠ 0
117	X=Y?	16-34		173	3	03	go to LBL C
118	GT03	22 03		174	RCL6	36 15	
119	*LBL4	21 04	return B <sub>s</sub>	175	X=Y?	16-32	
120	RCL2	36 02		176	GT00	22 16 13	
121	RTH	24		177	.	-62	else
122	*LBL3	21 03	if X <sub>e</sub> ≤ 75	178	9	09	go to LBL7
123	7	07		179	STX2	35-35 02	F <sub>s</sub> ← .9 F <sub>s</sub>
124	5	05	go to LBL5	180	GT07	22 07	
125	RCL5	36 05		181	*LBL0	21 16 13	if
126	X=Y?	16-35		182	RCL6	36 15	20 > H
127	GT05	22 05	else return	183	2	02	return F <sub>s</sub>
128	GT04	22 04	if 20 ≤ X <sub>e</sub>	184	0	00	if
129	*LBL5	21 05	go to LBL6	185	X=Y?	16-34	H > 40
130	2	02		186	GT07	22 07	and
131	0	00	else return	187	RCL6	36 15	2ω <sub>s</sub> ≤ .96
132	X=Y?	16-35	return	188	4	04	and
133	GT06	22 06		189	0	00	.84 ≤ 2ω <sub>s</sub>
134	GT04	22 04		190	X=Y?	16-34	then
135	*LBL6	21 06		191	GT06	22 06	F <sub>s</sub> ← 1.1 F <sub>s</sub>
136	RCL2	36 02		192	.	-62	
137	1	01	B <sub>s</sub> ← B <sub>s</sub> * (1.2)	193	9	09	
138	.	-62		194	6	06	
139	2	02		195	RCL6	36 07	
140	X	-35		196	X=Y?	16-34	
141	RTH	24		197	GT08	22 08	
142	*LBL6	21 16 12	Compute F <sub>s</sub>	198	.	-62	
143	RCL6	36 15		199	8	08	
144	3	03		200	4	04	
145	.	-62		201	X=Y?	16-34	
146	RCL6	36 15		202	GT08	22 08	
147	1	01		203	1	01	
148	2	02		204	.	-62	
149	0	00		205	1	01	
150	+	-55		206	STX2	35-35 02	
151	=	-24		207	GT07	22 07	
152	.	-62		208	*LBL8	21 08	else
153	2	02		209	1	01	F <sub>s</sub> ← 1.05 F <sub>s</sub>
154	2	02		210	.	-62	
155	+	-55		211	0	00	
156	1	01		212	5	05	
157	RCL6	36 06		213	STX2	35-35 02	
158	.	-62		214	*LBL7	21 07	
159	5	05		215	RCL2	36 02	return
160	X	-35		216	RTH	24	
161	Y*	31		217	R/S	51	
162	ST02	35 02	save in R <sub>32</sub>				
163	1	01	if 2ω <sub>s</sub> = 1				
164	RCL6	36 06	return				
165	X=Y?	16-33	thru LBL 7				
166	GT07	22 07					
167	.	-62					
168	8	08					

$$L_2 = .22 \times \left( \frac{H-3}{H+120} \right)^{5-10 \left( \frac{2\omega_s}{2} \right)}$$

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	ON OFF		DISP
a	b	c	d	e	1	0	<input type="checkbox"/>	DEG <input type="checkbox"/>
0	1	2	3	4	2	1	<input type="checkbox"/>	GRAD <input type="checkbox"/>
5	6	7	8	9	3	2	<input type="checkbox"/>	RAD <input type="checkbox"/>
						3	<input type="checkbox"/>	ENG <input type="checkbox"/>



## CARD GM-6 Cg, DETAIL WALL PORTION

C-17

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	input Cg and X0 or Xc	057	X>Y?	1E-34	then Bc ← 1
002	P2S	16-51	get secondary register	058	.	01	
003	ST05	35 05	save X	059	*LBL2	21 02	get primary register
004	P2S	16-51	get primary registers	060	P2S	16-51	on stack { Cg or Bf
005	R↓	-31		061	RCL0	36 00	save Bc or Bf
006	ST00	35 00	save Cg	062	XZ Y	-41	Bc ← (Bc or Bf)
007	RTN	24		063	ST00	35 00	
008	*LBL5	21 12	compute Cg * Bc	064	X	-35	
009	RCL0	36 00	get Cg	065	SPC	16-11	display
010	P2S	16-51	get secondary register	066	2	02	Code 2 and
011	RCL5	36 05		067	PRTX	-14	Cg = Bc or
012	.	01	compute	068	R↓	-31	Cg * Bf
013	ENT↑	-21		069	PRTX	-14	
014	3	03		070	RTN	24	
015	.	-62		071	*LBLC	21 13	compute Cg * Bf
016	5	05		072	RCL0	36 00	get Cg
017	ENT↑	-21		073	P2S	16-51	get secondary register
018	2	02		074	RCL5	36 05	if 2.5 ≤ X
019	.	-62		075	2	02	
020	3	03		076	.	-62	
021	RCL4	36 04		077	5	05	go to LBL 3
022	X	-35		078	XZ Y?	16-35	
023	CHS	-22		079	GT03	22 03	
024	e <sup>x</sup>	33		080	R↓	-31	if X ≥ 2.5
025	X	-35		081	.	-62	compute
026	-	-45		082	2	02	
027	.	-62		083	2	02	
028	1	01		084	4	04	
029	CHS	-22		085	8	08	
030	RCL5	36 05		086	CHS	-22	
031	X	-35		087	X	-35	
032	e <sup>x</sup>	33		088	e <sup>x</sup>	33	
033	X	-35		089	GT02	22 02	
034	3	03		090	*LBL3	21 03	
035	.	-62		091	R↓	-31	if ≤ 10
036	5	05		092	1	01	
037	ENT↑	-21		093	0	00	
038	2	02		094	XZ Y	-41	go to LBL4
039	.	-62		095	XZ Y?	16-35	
040	3	03		096	GT04	22 04	
041	RCL4	36 04		097	ENT↑	-21	else if
042	X	-35		098	ENT↑	-21	10 < X
043	CHS	-22		099	.	-62	compute
044	e <sup>x</sup>	33		100	3	03	
045	X	-35		101	8	08	
046	.	-62		102	CHS	-22	
047	0	00		103	Y <sup>x</sup>	31	
048	4	04		104	XZ Y	-41	
049	CHS	-22		105	.	-62	
050	RCL5	36 05		106	0	00	
051	X	-35		107	0	00	
052	e <sup>x</sup>	33		108	9	09	
053	X	-35		109	3	03	
054	+	-55		110	0	00	
055	1	01		111	CHS	-22	
056	XZ Y	-41	if Bc > 1	112	X	-35	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				



[illegible]

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 16 11	input L	057	RTN	24	
002	STOB	35 12		058	*LBLA	21 11	input w
003	XZY	41		059	STOB	35 03	
004	STOA	35 11	input w	060	RJ	-31	input y
005	XZY	41	e = w/L	061	STOB	35 05	
006	=	-24	save e	062	RJ	-31	input x
007	STOB	35 05		063	STOA	35 04	
008	RJ	-31	go compute	064	RJ	-31	go compute Bi
009	CS5d	23 16 14	Bi (Xi)	065	CS5d	23 16 14	
010	RTN	24		066	=	02	
011	*LBLd	21 16 14	compute	067	ST=3	35-24 03	$R_2 \leftarrow w/2$
012	1	01	Bi	068	RCL3	36 03	compute Az
013	1	01		069	RCL4	36 04	
014	0	00		070	+	-55	
015	XZY	-41		071	RCL5	36 05	
016	XZY?	16 34	if $X_i \leq 110$	072	=	-24	
017	STO1	22 01	compute	073	DEG	16-21	
018	-	-62		074	TAN	16 43	
019	0	00		075	RCL4	36 04	
020	2	02		076	RCL3	36 03	
021	3	03		077	-	-45	
022	9	09		078	RCL5	36 05	
023	CHS	-22		079	=	-24	
024	x	-35		080	TAN	16 43	
025	e <sup>x</sup>	33		081	-	-45	
026	1	01		082	3	03	
027	.	-62		083	6	06	
028	0	00		084	0	00	
029	0	00		085	=	-24	
030	3	03		086	STX2	35-35 02	$R_2 \leftarrow Bi - A_2$
031	1	01		087	RCL5	36 05	is
032	6	06		088	RCL4	36 04	$x + \frac{w}{2} \leq y$ ?
033	x	-35		089	RCL3	36 03	
034	1	01		090	+	-55	
035	XZY	-41	if $Bi > 1$	091	XZY?	16-35	
036	XZY?	16 34	then	092	STO3	22 03	
037	1	01	$Bi \leftarrow 1$	093	2	02	
038	STO2	22 02		094	x	-35	if
039	*LBL1	21 01	if $X_i > 110$	095	STOB	35 12	$x + \frac{w}{2} > y$
040	0	-62	compute	096	XZY	-41	then
041	0	00		097	2	02	$L = 2(x + \frac{w}{2})$
042	2	02		098	x	-35	$w = 2y$
043	1	01		099	XZY	-41	$e = w/L$
044	0	00		100	=	-24	
045	8	08		101	STOA	22 04	
046	CHS	-22		102	*LBL3	21 03	if
047	x	-35		103	RCL5	36 05	$x + \frac{w}{2} \leq y$
048	e <sup>x</sup>	33		104	X <sup>2</sup>	53	$L = 2\sqrt{x^2 + y^2}$
049	.	-62		105	RCL4	36 04	$w = L$
050	7	07		106	X <sup>2</sup>	53	$e = 1$
051	4	04		107	+	-55	
052	0	00		108	JX	54	
053	5	05		109	2	02	
054	x	-35		110	x	-35	
055	*LBL2	21 02	save Bi	111	STOB	35 12	
056	STO2	35 02	in R <sub>2</sub>	112	1	01	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	*LBL4	21 04	save e	161	+	-55	
114	STO6	35 06	in R <sub>6</sub>	162	JX	54	
115	RTN	24		163	x	-35	
116	*LBL6	21 12	input Z <sub>3</sub>	164	RCL6	36 06	
117	STO7	35 07		165	X*Y	-41	
118	R4	-31	input Z <sub>2</sub>	166	÷	-24	
119	STO9	35 09		167	RAD	16-22	
120	R4	-31	input Z <sub>1</sub>	168	TAN	16 47	
121	CHS	-22		169	2	02	
122	STO8	35 08	input H	170	x	-35	
123	R4	-31		171	PI	16-24	
124	STOE	35 15		172	÷	-24	
125	9	09	initialize counter	173	*LBL6	21 06	
126	STOI	35 46	$R_{50} \leftarrow W_2(3)$	174	STOI	35 45	
127	3	03	$R_{51} \leftarrow W_4'(Z_1)$	175	RTN	24	
128	GSBe	23 16 15	$R_{52} \leftarrow W_4(Z_3)$	176	*LBLC	21 13	
129	RCL8	36 08	$R_{53} \leftarrow W_4(Z_2)$	177	STOD	35 14	
130	GSBe	23 16 15	$R_{54} \leftarrow W_4'(Z_3-Z_2)$	178	R4	-31	
131	RCL7	36 07		179	STOC	35 17	
132	GSBe	23 16 15	$R_{55} \leftarrow W_4(Z_1-Z_3)$	180	RTN	24	
133	RCL9	36 09		181	*BLD	21 14	
134	GSBe	23 16 15		182	STOB	35 00	
135	RCL7	36 07		183	SPC	16-11	
136	RCL9	36 09		184	2	02	
137	-	-45		185	PRTX	-14	
138	GSBe	23 16 15		186	RTN	24	
139	RCL7	36 07		187	R/S	51	
140	RCL8	36 08					
141	+	-55					
142	GSBe	23 16 15					
143	RTN	24					
144	*LBL6	21 16 15					
145	TSZ1	16 26 46					
146	X#0?	16-42					
147	STO5	22 05					
148	1	01					
149	STO6	22 06					
150	*LBL5	21 05					
151	RCL8	36 12					
152	=	-24					
153	2	02					
154	x	-35					
155	ENT1	-21					
156	X <sup>2</sup>	55					
157	RCL6	36 06					
158	X <sup>2</sup>	55					
159	+	55					
160	1	01					

Computing

save w

input X<sub>a</sub>

input X<sub>c</sub>

input P<sub>a</sub>

call for

cord 2

initialize counter

$R_{50} \leftarrow W_2(3)$

$R_{51} \leftarrow W_4'(Z_1)$

$R_{52} \leftarrow W_4(Z_3)$

$R_{53} \leftarrow W_4(Z_2)$

$R_{54} \leftarrow W_4'(Z_3-Z_2)$

$R_{55} \leftarrow W_4(Z_1-Z_3)$

compute w

increment counter

if Z = 0

W = 1

if Z ≠ 0

compute

$$W = \frac{2}{K} \tan^{-1} \left( \frac{e}{2a\sqrt{u^2 + e^2}} \right)$$

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n <input type="checkbox"/>



## CARD GE-2 Cg, DETECTOR STORY

C-21

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	continue	057	ST05	35 05	save X <sub>i</sub> in R <sub>5</sub>
002	RCLC	36 13	compute	058	.	-62	compute B <sub>e</sub>
003	GSBc	23 16 13	B <sub>e</sub> (X <sub>c</sub> )	059	2	02	
004	ST03	35 03		060	CHS	-22	
005	RCLD	36 14	compute	061	RCLC	36 15	
006	GSBc	23 16 13	B <sub>e</sub> (X <sub>a</sub> )	062	x	-35	
007	ST04	35 04		063	e <sup>x</sup>	33	
008	RCLC	36 13	compute	064	.	-62	
009	GSBc	23 16 14	S <sub>w</sub> (X <sub>c</sub> )	065	4	04	
010	ST0C	35 13		066	x	-35	
011	RCLD	36 14	compute	067	.	-62	
012	GSBc	23 16 14	S <sub>w</sub> (X <sub>a</sub> )	068	0	00	
013	ST0D	35 14		069	3	03	
014	RCLC	36 06	compute E	070	CHS	-22	
015	ENT↑	-21		071	RCLC	36 15	
016	ENT↑	-21		072	x	-35	
017	1	01		073	e <sup>x</sup>	33	
018	+	-55		074	.	-62	
019	X=Y	-41		075	0	00	
020	X <sup>2</sup>	53		076	0	00	
021	1	01		077	0	00	
022	+	-55		078	6	06	
023	JX	54		079	6	06	
024	÷	-24		080	RCL5	36 05	
025	ST01	35 46	R <sub>1</sub> ← E (c)	081	x	-35	
026	SPC	16 11	call for	082	.	-62	
027	3	03	GE 3	083	2	02	
028	PRTX	-14		084	3	03	
029	RTN	24		085	2	02	
030	*LBLA	21 16 14	compute S <sub>w</sub>	086	+	-55	
031	ST08	35 08	R <sub>g</sub> ← X	087	x	-35	
032	3	03		088	+	-55	
033	0	00	R <sub>g</sub> ← 30	089	.	-62	
034	ST09	35 09		090	0	00	
035	3	03	if X > 35	091	0	00	
036	5	05	go compute	092	9	09	
037	RCLB	36 08		093	CHS	-22	
038	X>Y?	16 34	S <sub>w</sub>	094	RCLC	36 15	
039	ST01	22 01		095	x	-35	
040	4	04	else	096	e <sup>x</sup>	33	
041	ST+9	35 55 09	R <sub>g</sub> ← 34	097	.	-62	
042	RCLB	36 08	if	098	3	03	
043	1	01	X ≥ 13	099	x	-35	
044	3	03	go compute S <sub>w</sub>	100	+	-55	
045	X<Y?	16 35		101	.	-62	
046	ST01	22 01	else	102	0	00	
047	3	03	R <sub>g</sub> ← 37	103	0	00	
048	ST+9	35 55 09	compute	104	2	02	
049	*LBL1	21 01		105	2	02	
050	RCLB	36 08		106	0	00	
051	RCLB	36 08		107	CHS	-22	
052	RCL9	36 09		108	RCLC	36 15	
053	+	-55		109	x	-35	
054	+	-24		110	e <sup>x</sup>	33	
055	RTN	24		111	.	-62	
056	*LBLc	21 16 13	compute B <sub>e</sub>	112	0	00	

$$E = \frac{1 \times e}{\sqrt{e^{2x} + 1}}$$

$$R_1 \leftarrow E(c)$$

call for  
GE 3

compute S<sub>w</sub>  
R<sub>g</sub> ← X

$$R_g \leftarrow 30$$

if X > 35  
go compute

S<sub>w</sub>  
else  
R<sub>g</sub> ← 34

if  
X ≥ 13  
go compute S<sub>w</sub>

else  
R<sub>g</sub> ← 37  
compute

$$S_w = \frac{x}{x + R_g}$$

compute B<sub>e</sub>

$$B_e = [1.3e^{-0.0405x} + 0.7e^{-0.0209x}] (1.2e^{-0.0054x} - 0.0022x) + 0.3e^{-0.0094x} + (0.232 + 0.0066x)e^{-0.034x} + 0.4e^{-0.24x}$$

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
	b	c	d	e	1	ON OFF		
	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n

## CARD GE-2 (Continued)

C-22

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	0	00					
114	0	00					
115	5	05					
116	4	04					
117	CHS	-22					
118	RCL5	36 05					
119	x	-35					
120	.	-62					
121	2	02					
122	8	08					
123	+	-55					
124	x	-35					
125	+	-55					
126	.	-62					
127	0	00					
128	2	02					
129	0	00					
130	9	09					
131	CHS	-22					
132	RCL5	36 05					
133	x	-35					
134	e <sup>x</sup>	33					
135	.	-62					
136	7	07					
137	x	-35					
138	.	-62					
139	0	00					
140	4	04					
141	0	00					
142	8	08					
143	CHS	-22					
144	RCL5	36 05					
145	x	-35					
146	e <sup>x</sup>	33					
147	.	-62					
148	3	03					
149	x	-35					
150	+	-55					
151	x	-35					
152	1	01					
153	X <sup>2</sup> Y	-41					
154	X <sup>2</sup> Y?	16 34					
155	1	01					
156	RTH	24					
157	R/S	51					

Computing Be

if Be &gt; 1

then Be = 1

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

# CARD GE-3 Cg, DETECTOR STORY -

C-23

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLE	21 11	continue	057	R+	-31	else if H=3
002	F2S	16-51	get secondary registers	058	R+	-31	get back Gd
003	RCL1	36 01	compute	059	X<0?	16-45	if Gd < 0
004	GSBe	23 16 15	Gd (Wd)	060	B	00	Gd = 0
005	STD6	35 09	compute	061	RTN	24	return Gd
006	RCL6	36 00	compute	062	*LBLE	21 02	for H ≠ 3
007	GSBe	23 16 15	Gd (Wd)	063	R+	-31	get back Gd calc.
008	STO9	35 09	get primary registers	064	R+	-31	if Gd > .25
009	F2S	16-51	call for	065	.	-62	return Gd
010	SPC	16-11	program 4	066	2	02	
011	4	04		067	5	05	
012	PRTX	-14		068	X=Y	-41	
013	RTN	24		069	X>Y?	16-34	
014	*LBLE	21 16 15	Compute Gd	070	RTN	24	
015	STD6	35 06	save d	071	RCL6	36 15	else compute
016	1	01	if d = 1	072	.	-62	
017	-	-45	Gd = 0	073	3	03	
018	X=0?	16-43	compute Gd	074	2	02	
019	RTN	24	as follows	075	2	02	
020	RCL6	36 15		076	6	06	
021	.	-62		077	Y*	31	
022	0	00		078	.	-62	
023	1	01		079	0	00	
024	9	09		080	1	01	
025	3	03		081	4	04	
026	CHS	-22		082	0	00	
027	Y*	31		083	4	04	
028	.	-62		084	CHS	-22	
029	9	09		085	x	-35	
030	2	02		086	RCL6	36 15	
031	3	03		087	.	-62	
032	4	04		088	4	04	
033	x	-35		089	7	07	
034	RCL6	36 15		090	2	02	
035	.	-62		091	3	03	
036	2	02		092	CHS	-22	
037	3	03		093	Y*	31	
038	0	00		094	8	08	
039	3	03		095	.	-62	
040	Y*	31		096	6	06	
041	.	-62		097	3	03	
042	1	01		098	CHS	-22	
043	5	05		099	x	-35	
044	8	08		100	RCL6	36 06	
045	4	04		101	LN	32	
046	x	-35		102	x	-35	
047	1	01		103	+	-55	
048	RCL6	36 06		104	.	-62	
049	-	-45		105	0	00	
050	LN	32		106	4	04	
051	x	-35		107	X=Y	-41	
052	+	-55		108	X>Y?	16-34	
053	RCL6	36 15		109	RTN	24	
054	3	03		110	RCL6	36 15	
055	X≠Y?	16-34		111	2	02	
056	GT02	22 02		112	0	00	

$G_d = 9234H + 0193 + .1584 \cdot 2303 \log(1-d)$

$G_d = -.01404H + .3226 + .63H + .4723 \log d$

if H ≠ 3  
go to LBL 2

if Gd > .04  
OK return  
else  
if 20 ≤ H

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J



CARD GE-3 (Continued)

C-24

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	XEQ?	16-25	go to LBL 1	169	RTN	24	
114	GT01	22-01		170	R/S	51	
115	R↓	-31	else return				
116	R↓	-31					
117	RTN	24	G <sub>d</sub> calculated				
118	*LBL1	21 01	compute				
119	RCL6	36 15					
120	.	-62					
121	4	04					
122	5	05					
123	9	09					
124	7	07					
125	CHS	-22					
126	Y*	31					
127	.	-62					
128	0	00					
129	9	09					
130	3	03					
131	8	08					
132	9	09					
133	CHS	-22					
134	x	-35					
135	RCL6	36 15					
136	.	-62					
137	6	06					
138	9	09					
139	4	04					
140	4	04					
141	CHS	-22					
142	Y*	31					
143	1	01					
144	2	02					
145	.	-62					
146	7	07					
147	7	07					
148	CHS	-22					
149	x	-35					
150	RCL6	36 06					
151	LN	32					
152	x	-35					
153	+	-55					
154	.	-62					
155	0	00					
156	0	00					
157	6	06					
158	XEQ?	16-34					
159	GT03	22 03					
160	R↓	-31					
161	RTN	24					
162	*LBL3	21 03					
163	1	01					
164	RCL6	36 06					
165	.	-62					
166	.	-62					
167	3	03					
168	x	-35					

$G_d = 0.09389 H - 4597$   
 $-12.77 H - 6944 \log D$   
 $G_d$   
 $G_d = (1 - \omega) \cdot 3$

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n

## CARD GE-4 Cg, DETECTOR STORY

C-25

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 16 11	continue	057	STOD	35 14	
002	P2S	16-51	get secondary registers	058	RCL7	36 07	$R_c \leftarrow C_g$
003	RCL5	36 05	compute	059	RCL1	36 46	
004	GSA 23 16 11		$G_s(\omega_c) - G_s(\omega'_c)$	060	x	-35	$C_g = [G_s(\omega_c) + G_s(\omega'_c)]$
005	STO5	35 05		061	RCLC	36 13	
006	RCL4	36 04	save in $R_{SS}$	062	x	-35	
007	GSA 23 16 11			063	1	01	$x [E \cdot S_w(x_c) + (1-S_w)x_g]$
008	ST-5	35-45 05		064	RCLC	36 13	
009	RCL2	36 02	compute $G_s(\omega_c)$	065	-	-45	$x [G_s(\omega_c) + G_s(\omega'_c)]$
010	GSA 23 16 11			066	RCL9	36 09	
011	ST+9	35-55 09	$R_{SS} \leftarrow G_s(\omega_c) + G_s(\omega'_c)$	067	x	-35	
012	.	-62	compute	068	+	-55	
013	1	01		069	STOC	35 13	
014	X*Y	-41	$R_{SS} x [5(1-G_s(\omega'_c))]$	070	RCL5	36 05	$R_B \leftarrow R_{SS} - G_c$
015	-	-45		071	STOB	35 12	get primary registers
016	5	05	$= G_c$	072	P2S	16-51	compute
017	x	-35		073	RCLC	36 13	
018	STx5	35-35 05		074	RCL3	36 03	
019	RCL3	36 03	$R_B \leftarrow R_B + G_s(\omega'_c)$	075	x	-35	$[-B_c(e) - C_g]$
020	GSA 23 16 11			076	RCLD	36 14	
021	ST+8	35-55 08		077	RCL4	36 04	$+ (B_{ca} \cdot C_a - B_{ca} \cdot C_e)$
022	RCL3	36 03		078	x	-35	
023	GSA 23 16 12		$R_c \leftarrow G_c(\omega_c)$	079	RCLA	36 11	
024	STO6	35 06		080	CHS	-22	$+ B_{ca} - G_c)(P_a)]$
025	RCL1	36 01		081	RCL3	36 03	
026	GSA 23 16 12		$R_c \leftarrow R_c + G_s(\omega'_c)$	082	x	-35	
027	ST+6	35-55 06		083	+	-55	$x [A_z - B_i]$
028	RCL0	36 00		084	RCLB	36 12	
029	GSA 23 16 12		$R_g \leftarrow G_s(\omega_c) + G_s(\omega'_c)$	085	RCL4	36 04	
030	STO7	35 07		086	x	-35	
031	RCL2	36 02		087	+	-55	
032	GSA 23 16 12			088	RCL0	36 00	
033	ST+7	35-55 07		089	x	-35	
034	RCL6	36 06	$R_A \leftarrow C_a$	090	+	-55	
035	RCL1	36 46		091	RCL2	36 02	
036	x	-35	$C'_a = [G_s(\omega_c) + G_s(\omega'_c)]$	092	x	-35	
037	RCLC	36 13		093	SPC	16-11	print code 2
038	x	-35	$x [E (S_w(x_c))$	094	2	-02	and $C_g$
039	1	01	$+ 1 - S_w(x_c)]$	095	PRTX	-14	
040	RCLC	36 13		096	RJ	-31	
041	-	-45	$[G_s(\omega'_c) + G_s(\omega_c)]$	097	PRTX	-14	
042	RCL8	36 08		098	RTN	24	
043	x	-35		099	*LBLA	21 16 11	compute $G_c$
044	+	-55		100	STOE	35 15	save $\omega$
045	STOA	35 11		101	.	-62	if $\omega \leq .7$
046	RCL6	36 06	$R_0 \leftarrow C_a$	102	7	07	
047	RCL1	36 46		103	RCLC	36 13	go to LBL3
048	x	-35	$C_a = [G_s(\omega_c) + G_s(\omega'_c)]$	104	X*Y?	16-35	
049	RCLD	36 14		105	STO3	22 03	
050	x	-35	$x [E \cdot S_w(x_c) + (1-S_w)x_g]$	106	.	-62	if $.7 < \omega < .85$
051	1	01		107	8	08	
052	RCLD	36 14	$x [G_s(\omega'_c) + G_s(\omega_c)]$	108	5	05	go to LBL4
053	-	-45		109	X*Y?	16-35	
054	RCLB	36 08		110	STO4	22 04	
055	x	-35		111	.	-62	
056	+	-55		112	2	02	

## REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

CARD GE-4 (Continued)

C-26

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	2	02	for $.5 \geq W$ compute  $G_2 = .222(1-W) \cdot 988$				
114	2	02					
115	ENT↑	-21					
116	.	-52					
117	9	09					
118	6	06					
119	8	08					
120	*LBL5	21 05					
121	ENT↑	-21					
122	1	01					
123	RCLE	36 15	for $W \leq .7$ compute  $G_2 = .102(1-W) \cdot 465$				
124	-	-45					
125	X=Y	-41					
126	YX	31					
127	X	-35					
128	RTN	24					
129	*LBL3	21 03					
130	.	-62					
131	1	01					
132	0	00					
133	2	02	compute $G_s$ get $G_a$  $G_s = 56_a$				
134	ENT↑	-21					
135	.	-62					
136	4	04					
137	6	06					
138	5	05					
139	GT05	22 05					
140	*LBL4	21 04					
141	.	-62					
142	1	01					
143	4	04					
144	8	08					
145	ENT↑	-21					
146	.	-62					
147	7	07					
148	7	07					
149	9	09					
150	GT05	22 05					
151	*LBL6	21 16 12					
152	GSBa	23 16 11					
153	5	05					
154	X	-35					
155	RTN	24					
156	R/S	01					

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n _____



TITLE 02**SR 52**

C-27

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		+/-	94		+/-	94
	A	11		X	65	075	X	65
	STD	42		RCL	43		RCL	43
	0	00	040	1	01		1	01
	0	00		1	01		1	01
005	*RTN	56		)	54		)	54
	*LBL	46		INV	22	080	IN	22
	B	12		lnx	23		lnx	23
	STD	42	045	)	54		)	54
	1	01		GTO	41		GTO	41
010	1	01		*1'	87		*1'	87
	*RTN	56		LBL	46	085	LBL	46
	*LBL	46		*2'	88		*3'	89
	C	13	050	(	53		(	53
	CLR	25		RCL	43		.	93
	(	53		1	01		5	05
	RCL	43		1	01	090	3	03
	1	01		-	75		8	08
	1	01	055	9	09		5	05
	-	75		0	00		2	02
020	2	02		)	54		X	65
	0	00		*IF POS	80	095	(	53
	)	54		*3'	89		.	93
	*IF POS	80	060	(	53		0	00
	*2'	88		.	93		2	02
025	(	53		8	08		3	03
	.	93		0	00	100	0	00
	9	09		0	00		3	03
	8	08	065	1	01		+/-	94
	8	08		X	65		X	65
030	5	05		(	53		RCL	43
	X	65		.	93	105	1	01
	(	53		0	00		1	01
	.	93	070	2	02		)	54
	0	00		7	07		INV	22
035	3	03		2	02		lnx	23
	7	07		3	03	110	)	54

TITLE 02 (continued)

**SR 52**

6-60

## PROGRAM FORM

[illegible]

TITLE 01a1

**SR 52**

C-29

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			STO 42			0 0	
	A 11			1 1		075	3 3	
	STO 42			0 0			2 2	
	0 0		040	4 4			*RTN 56	
	6 6			STO 42			*LBL 46	
005	2 2			1 1			E 15	
	STO 42			1 1		080	*STFLG 50	
	0 0			E 15			1 1	
	1 1		045	STO 42			( 53	
	1 1			0 0			*IND 36	
010	*RTN 56			1 1			RCL 43	
	*LBL 46			5 5		085	1 1	
	B 12			STO 42			0 0	
	*IND 36		050	1 1			X 63	
	STO 42			1 1			*IND 36	
(	0 0			E 15			RCL 43	
	1 1			STO 42		090	1 1	
	1 1			0 0			1 1	
	SUM 44		055	2 2			) 54	
	0 0			3 3			INV 22	
020	1 1			STO 42			*IFZRD 90	
	RCL 43			1 1		095	*5' 78	
	0 0			0 0			0 0	
	1 1		060	4 4			*RTN 56	
	- 75			STO 42			*LBL 46	
025	1 1			1 1			*5' 78	
	= 95			1 1		100	*IFPOS 80	
	*RTN 56			E 15			*1' 87	
	*LBL 46		065	STO 42			INV 22	
	C 13			0 0			*STFLG 50	
030	STO 42			4 4			1 1	
	0 0			5 5		105	*LBL 46	
	7 7			STO 42			*1' 87	
	*RTN 56		070	1 1			*IND 36	
	*LBL 46			1 1			RCL 43	
035	D 14			E 15			1 1	
	2 2			STO 42		110	0 0	



TITLE 01a1 (continued)

**SR 52**

C-30

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	*IFPOS	80		*LBL	46	185	RCL	43
	* 2'	88		* 4'	77		0	0
	+/-	94	150	(	53		9	9
	*LBL	46		RCL	43		X	65
115	* 2'	88		1	1		(	53
	STD	42		2	2	190	RCL	43
	1	1		÷	55		0	0
	2	2	155	RCL	43		9	9
	*IND	36		1	1		*X <sup>2</sup>	40
120	RCL	43		3	3		+	85
	1	1		)	54	195	RCL	43
	1	1		STD	42		0	0
	*IFPOS	80	160	0	0		8	8
	* 3'	89		8	8		*X <sup>2</sup>	40
125	+/-	94		(	53		+	85
	*LBL	46		RCL	43	200	1	1
	* 3'	89		0	0		)	54
	(	53	165	6	6		*√X	30
	STD	42		÷	55		)	54
130	1	1		RCL	43		)	54
	3	3		1	1	205	INV	22
	-	75		3	3		tan	34
	RCL	43	170	)	54		)	54
	1	1		STD	42		*IF FLG	60
135	2	2		0	0		1	1
	)	54		9	9	210	* 6'	79
	*IFPOS	80		(	53		+/-	94
	* 4'	77	175	2	2		*LBL	46
	RCL	43		÷	55		* 6'	79
140	1	1		*TH	59		*RTN	56
	2	2		X	65	215		
	*EXC	48		(	53			
	1	1	180	RCL	43			
	3	3		0	0			
145	STD	42		8	8			
	1	1		÷	55			
	2	2		(	53			

TITLE 01a2**SR 52**PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			*IF 200 90			- 75	
	A 11			*4' 77		075	RCL 43	
	O 00			*IF POS 80			O 00	
	STD 42		040	*7' 67			9 09	
	O 00			+/- 94			) 54	
005	G 06			INV 22			*IF POS 80	
	4 04			*STFLG 50		080	*8' 68	
	STD 42			1 01			*IF 200 90	
	O 00		045	*LBL 46			*8' 68	
	O 00			*7' 67			( 53	
010	*LBL 46			STD 42			1 01	
	*6' 79			O 00		085	. 93	
	E 15			9 09			3 03	
	SUM 44		050	CLR 25			- 75	
	O 00			( 53			1 01	
( 5	G 06			. 93			. 93	
	*DSZ 58			3 03		090	G 06	
	*6' 79			2 02			X 65	
	( 53		055	2 02			( 53	
	RCL 43			X 65			. 93	
020	O 00			( 53			O 00	
	G 06			. 93		095	1 01	
	÷ 55			O 00			G 06	
	4 04		060	2 02			7 07	
	) 54			2 02			4 04	
025	STD 42			3 03			+/- 94	
	O 00			9 09		100	X 65	
	O 00			+/- 94			RCL 43	
	*RTH 50		065	X 65			O 00	
	*LBL 46			( 53			7 07	
030	E 15			RCL 43			) 54	
	*STFLG 50			O 00		105	INV 22	
	1 01			7 07			Inv 23	
	*IND 36		070	+ 85			) 54	
	RCL 43			( 53			X 65	
035	O 00			. 93			( 53	
	O 00			1 01		110	3 03	

TITLE 01a2 (continued)

**SR 52**

C-32

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	0	00		INV	22	185	1	01
	.	93		lnx	23		1	01
	3	03	150	X	65		-	75
	X	65		RCL	43		RCL	43
115	RCL	43		0	00		0	00
	0	00		9	09	190	8	08
	9	09		y <sup>x</sup>	45		)	54
	y <sup>x</sup>	45	155	(	53		*ifpos	80
	1	01		1	01		*1'	87
120	.	93		.	93		(	53
	1	01		0	00	195	RCL	43
	-	75		3	03		0	00
	.	93	160	-	75		8	08
	2	02		(	53		-	75
125	3	03		.	93		.	93
	4	04		0	00	200	1	01
	X	65		0	00		7	07
	RCL	43	165	0	00		)	54
	0	00		4	04		*ifpos	80
130	9	09		6	06		*1'	87
	y <sup>x</sup>	45		X	65	205	.	93
	.	93		RCL	43		9	09
	7	07	170	0	00		*PROD	49
	3	03		7	07		0	00
135	4	04		=	95		8	08
	5	05		STD	42	210	*LBL	46
	+/-	94		0	00		*1'	87
	)	54	175	8	08		RCL	43
	GTO	41		RCL	43		0	00
140	*9'	69		0	00		8	08
	*LBL	46		7	07	215	*Hfg	60
	*8'	68		*ifpos	80		1	01
	0	00	180	*1'	87		*4'	77
	*LBL	46		(	53		+/-	94
145	*9'	69		.	93		*LBL	46
	)	54		0	00	220	*4'	77
	)	54		0	00		*RTH	56



TITLE 01b**SR 52**

C-83

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		0	00		2	02
	A	11		6	06	075	-	75
	STO	42		÷	55		.	93
	0	00	040	(	53		1	01
	3	03		RCL	43		)	54
005	*RTN	56		0	00		*IF POS	80
	*LBL	46		5	05	080	*1'	87
	B	12		÷	55		*IF ZRO	90
	STO	42	045	RCL	43		*1'	87
	0	00		0	00		0	00
010	4	04		4	04		GTO	41
	*RTN	56		X	65	085	*2'	88
	*LBL	46		2	02		LBL	46
	C	13	050	X	65		*1'	87
	STO	42		(	53		(	53
015	0	00		*X <sup>2</sup>	40		1	01
	5	05		+	85	090	.	93
	*RTN	56		RCL	43		3	03
	*LBL	46	055	0	00		-	75
	D	14		6	06		1	01
020	STO	42		*X <sup>2</sup>	40		.	93
	0	00		+	85	095	6	06
	1	01		1	01		X	65
	*RTN	56	060	)	54		(	53
	*LBL	46		*√X	30		.	93
025	E	15		)	54		0	00
	CLR	25		)	54	100	1	01
	RCL	43		INV	22		6	06
	0	00	065	TAN	34		7	07
	3	03		X	65		4	04
030	÷	55		2	02		+/-	94
	RCL	43		÷	55	105	X	65
	0	00		*π	59		RCL	43
	4	04	070	=	95		0	00
	=	95		(	53		1	01
035	(	53		STO	42		)	54
	STO	42		0	00	110	INV	22

TITLE 016 (CONTINUED)

**SR 52**

c-34

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	lnX	23		(	53	185	0	00
	)	54		(	53		0	00
	X	65	150	STO	42		4	04
	(	53		+	85		6	06
115	3	03		RCL	43		X	65
	0	00		0	00	190	RCL	43
	.	93		1	01		0	00
	3	03	155	)	54		1	01
	X	65		X	65		=	95
120	RCL	43		.	93		STO	42
	0	00		0	00	195	0	00
	2	02		2	02		0	00
	4 <sup>x</sup>	45	160	2	02		*RTN	56
	1	01		3	03			
125	.	93		9	09			
	1	01		+/-	94			
	-	75		)	54			
	.	93	165	INV	22			
	2	02		lnX	23			
130	3	03		X	65			
	4	04		.	93			
	X	65		3	03			
	RCL	43	170	2	02			
	0	00		2	02			
135	2	02		X	65			
	4 <sup>x</sup>	45		RCL	43			
	.	93		0	00			
	7	07	175	2	02			
	3	03		4 <sup>x</sup>	45			
140	4	04		(	53			
	5	05		1	01			
	+/-	94		.	93			
	)	54	180	0	00			
	=	95		3	03			
145	LBL	46		-	75			
	* 2 <sup>1</sup>	88		.	93			
	(	53		0	00			

TITLE GM-1

**SR 52**

C-35

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		*RTN	56		3	03
	*E	10		*LBL	46	075	-	75
	CLR	25		*A'	16		5	05
	1	01	040	*D'	19		)	54
	9	09		(	53		*1520	90
005	STO	42		STO	42		*2	BB
	0	00		0	00	080	RCL	43
	0	00		3	03		0	00
	0	00	045	-	75		3	03
	STO	42		4	04		*RTN	56
010	0	00		)	54		*LBL	46
	8	08		*1520	90	085	*2	BB
	1	01		*1	01		*C'	18
	STO	42	050	RCL	43		2	02
	0	00		0	00		INV	22
	2	02		3	03		*PROD	49
	STO	42		*RTN	56	090	1	01
	0	00		*LBL	46		6	06
	1	01	055	*1	87		(	53
	*RTN	56		*C'	18		RCL	43
020	*LBL	46		0	00		1	01
	*D'	19		*D'	19	095	8	08
	*IND	36		*RTN	56		+	85
	STO	42	060	*LBL	46		RCL	43
	0	00		A	11		1	01
025	0	00		*LBL	46		6	06
	INV	22		B	12	100	)	54
	*ds2	58		*LBL	46		÷	55
	*D'	19	065	C	13		RCL	43
	(	53		*LBL	46		1	01
030	2	02		D	14		7	07
	0	00		*LBL	46	105	=	95
	-	75		E	15		INV	22
	RCL	43	070	*D'	19		TAN	34
	0	00		(	53		-	75
035	0	00		STO	42		(	53
	)	54		0	00	110	(	53



TITLE GM-1 (continued)

**SR 52**

C-36

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	RCL	43		1	01	185	1	01
	1	01		0	00		1	01
	8	08	150	)	54		+/-	94
	-	75		*if pos	80		)	54
115	RCL	43		*5	78		INV	22
	1	01		(	53	190	lnx	23
	6	06		RCL	43		X	65
	)	54	155	1	01		.	93
	÷	55		9	09		7	07
120	RCL	43		X	65		4	04
	1	01		.	93	195	0	00
	7	07		0	00		5	05
	)	54	160	2	02		*LBL	46
	INV	22		3	03		*6	79
125	TAN	34		9	09		=	95
	=	95		+/-	94	200	(	53
	÷	55		)	54		STD	42
	2	02	165	INV	22		1	01
	÷	55		lnx	23		9	09
130	*T	57		X	65		-	75
	=	95		1	01	205	1	01
	*PRD	49		.	93		)	54
	1	01	170	0	00		*if pos	80
	9	09		0	00		*7	67
135	RCL	43		3	03		*RTN	56
	0	00		GTO	41	210	*LBL	46
	3	03		*6	79		*7	67
	*RTN	56	175	*LBL	46		1	01
	*LBL	46		*5	78		STD	42
140	*C'	18		(	53		1	01
	(	53		RCL	43	215	9	09
	(	53		1	01		*RTN	56
	RCL	43	180	9	09			
	1	01		X	65			
145	9	09		.	93			
	-	75		0	00			
	1	01		2	02			

TITLE GM-2**SR 52**

C-37

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			7 07			*E' 10	
	A 11			STD 42		075	RCL 43	
	RCL 43			1 01			1 01	
	1 01		040	8 08			4 04	
	6 06			GTO 41			*E' 10	
005	*if pos 90			*1 87			RCL 43	
	*1 87			*LBL 46		080	1 01	
	RCL 43			*2 88			2 02	
	1 01		045	RCL 43			- 75	
	8 08			1 01			RCL 43	
010	+ 85			8 08			1 01	
	RCL 43			+ 85		085	3 03	
	1 01			RCL 43			= 95	
	6 06		050	1 01			*E' 10	
	- 75			6 06			RCL 43	
C -	RCL 43			= 95			1 01	
	1 01			X 65		090	2 02	
	7 07			2 02			- 75	
	= 95		055	= 95			RCL 43	
	*if pos 80			*EXC 48			1 01	
020	*2 88			1 01			4 04	
	RCL 43			7 07		095	= 95	
	1 01			X 65			*E' 10	
	8 08		060	2 02			RCL 43	
	*x <sup>2</sup> 40			= 95			1 01	
025	+ 85			STD 42			2 02	
	RCL 43			1 01		100	*E' 10	
	1 01			8 08			RCL 43	
	7 07		065	*LBL 46			0 00	
	*x <sup>2</sup> 40			*1 87			8 08	
030	= 95			7 07			*if pos 90	
	*√x 30			STD 42		105	*6 79	
	X 65			0 00			X 65	
	2 02		070	0 00			2 02	
	= 95			RCL 43			= 95	
035	STD 42			1 01			SUM 44	
	1 01			3 03		110	1 01	

TITLE GM-2 (continued)**SR 52**

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	7	07		INV	22	185	* 1/2	20
	SUM	44		* s flg	50		X	65
	1	01	150	1	01		RCL	43
	8	08		* if pos	80		1	01
115	RCL	43		* 4	77		8	08
	1	01		* s flg	50	190	÷	55
	5	05		1	01		RCL	43
	* E'	10	155	+/-	94		1	01
	RCL	43		* LBL	46		7	07
120	1	01		* 4	77		=	95
	5	05		STD	42	195	INV	22
	+	85		÷	55		TAN	34
	RCL	43	160	RCL	43		X	65
	1	01		1	01		2	02
125	2	02		7	07		÷	55
	=	95		X	65	200	* π	59
	* E'	10		2	02		=	95
	RCL	43	165	=	95		INV	22
	0	00		X	65		* if flg	60
130	8	08		(	53		1	01
	X	65		* x <sup>2</sup>	40	205	* 5	78
	2	02		+	85		+/-	94
	=	95	170	(	53		* LBL	46
	INV	22		RCL	43		* 5	78
135	SUM	44		1	01		* IND	36
	1	01		8	08	210	STD	42
	7	07		÷	55		0	00
	INV	22	175	RCL	43		0	00
	SUM	44		1	01		* dsz	58
140	1	01		7	07		* 6	79
	8	08		)	54	215	* LBL	46
	3	03		* x <sup>2</sup>	40		* 6	
	* RTN	56	180	+	85		3	03
	* LBL	46		1	01		* RTN	56
145	* E'	10		)	54		* LBL	46
	* if pos	90		* √x	30	220	* 7	67
	* 7	67		=	95		1	01
							GTO	41 223 * 5 78



TITLE GM-3

**SR 52**

C-39

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			6 06			*9 69	
	A 11			*EXC 48		075	0 00	
	CLR 25			1 01			STD 42	
	RCL 43		040	7 07			0 00	
	0 00			INV 22			4 04	
005	1 01			*PROD 49			GTD 41	
	- 75			1 01		080	*4 77	
	RCL 43			8 08			*LBL 46	
	0 00		045	RCL 43			*8 68	
	5 05			1 01			RCL 43	
010	= 95			0 00			0 00	
	*if pos 80			INV 22		085	4 04	
	*3 89			*if zero 90			*B' 17	
	RCL 43		050	*9 69			STD 42	
	0 00			RCL 43			0 00	
015	1 01			1 01			4 04	
	STD 42			4 04		090	RCL 43	
	0 00			+ 85			0 00	
	5 05		055	3 03			5 05	
	- 75			= 95			*B' 17	
020	RCL 43			INV 22			INV 22	
	0 00			*if pos 80		095	SUM 44	
	4 04			*9 69			0 00	
	= 95		060	RCL 43			4 04	
	*if pos 80			1 01			RCL 43	
025	*3 89			2 02			0 00	
	SUM 44			- 75		100	3 03	
	0 00			RCL 43			*A' 16	
	4 04		065	1 01			+/- 94	
	*LBL 46			3 03			+ 85	
030	*3 89			= 95			• 93	
	0 00			INV 22		105	1 01	
	STD 42			*if pos 80			= 95	
	0 00		070	*9 69			*PROD 49	
	1 01			GTD 41			0 00	
035	STD 42			*8 68			4 04	
	1 01			*LBL 46		110	*LBL 46	

TITLE GM-3 (continued)**SR 52**

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	* 4	77		* LBL	46	165	* A'	16
	RCL	43		* 2	88		+/-	94
	0	00	150	+/-	94		+	85
	7	07		* B'	17		1	01
115	INV	22		SUM	44		=	95
	* if pos	80		1	01	190	STD	42
	* 1	87		7	07		0	00
	* B'	17	155	GTD	41		0	00
	SUM	44		* 6	79		X	65
120	1	01		* LBL	46		.	95
	7	07		* 1	87	195	2	02
	÷	55		RCL	43		4	04
	5	05	160	0	00		-	75
	=	95		6	06		.	93
125	SUM	44		+/-	94		1	01
	1	01		* B'	17	200	4	04
	6	06		SUM	44		X	65
	RCL	43	165	1	01		RCL	43
	0	00		7	07		0	00
130	6	06		RCL	43		0	00
	INV	22		0	00	205	y <sup>2</sup>	45
	* if pos	80		7	07		1	01
	* 2	88	170	+/-	94		.	93
	* B'	17		* B'	17		7	07
135	INV	22		INV	22		5	05
	SUM	44		SUM	44	210	=	95
	1	01		1	01		* RTN	56
	7	07	175	7	07		* LBL	46
	÷	55		* LBL	46		* B'	17
140	5	05		* 6	79		* A'	16
	=	95		4	04	215	STD	42
	INV	22		* RTN	56		X	65
	SUM	44	180	* LBL	46		5	05
	1	01		* 7	67		=	95
145	6	06		5	05		* RTN	56
	GTD	41		* RTN	56	220		
	* 7	67		* LBL	46			

TITLE GM-4**SR 52**

C-41

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			0 00			*LBL 46	
	A 11			7 07		075	*E' 10	
	CLR 25			- 75			STO 42	
	RCL 43		040	RCL 43			0 00	
	0 00			0 00			5 05	
005	6 06			2 02			- 75	
	*ifpos 80			= 95		080	1 01	
	* 6 79			INV 22			= 95	
	+/- 94		045	*ifpos 80			*if 210 90	
	STO 42			* 5 78			* 9 69	
010	0 00			RCL 43			• 93	
	6 06			0 00		085	9 09	
	- 75			2 02			2 02	
	RCL 43		050	STO 42			X 65	
	0 00			0 00			RCL 43	
5	2 02			7 07			1 01	
	= 95			*LBL 46		090	5 05	
	*ifpos 80			* 5 78			y <sup>x</sup> 45	
	* 6 79		055	RCL 43			• 93	
	RCL 43			0 00			0 00	
020	0 00			6 06			2 02	
	7 07			*E' 10		095	+/- 94	
	INV 22			SUM 44			+ 85	
	*ifpos 80		060	0 00			• 93	
	* 4 77			1 01			1 01	
025	RCL 43			RCL 43			6 06	
	0 00			0 00		100	X 65	
	2 02			7 07			RCL 43	
	STO 42		065	*E' 10			1 01	
	0 00			INV 22			5 05	
030	7 07			SUM 44			y <sup>x</sup> 45	
	GTD 41			0 00		105	• 93	
	* 5 78			1 01			2 02	
	*LBL 46		070	*LBL 46			3 03	
	* 4 77			* 6 79			X 65	
035	+/- 94			5 05			( 53	
	STO 42			*RTN 56		110	1 01	



# PROGRAM FORM

[illegible]

TITLE GM-5**SR 52**

C-43

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			1 01			*C' 18	
	A 11			- 75		075	( 53	
	CLR 25			RCL 43			( 53	
	1 01		040	0 00			STO 42	
	+ 85			9 09			1 01	
005	RCL 43			= 95			4 04	
	1 01			STO 42		080	X 65	
	8 08			0 00			. 93	
	= 95		045	5 05			0 01	
	÷ 55			RCL 43			4 04	
010	( 53			1 01			1 01	
	RCL 43			0 00		085	+/- 94	
	1 01			*C' 18			) 54	
	8 08		050	STO 42			INV 22	
	*x <sup>2</sup> 40			0 00			lnx 23	
015	+ 85			3 03			X 65	
	1 01			RCL 43		090	. 93	
	) 54			1 01			3 03	
	*√x 30		055	1 01			+ 85	
	= 95			*C' 18			. 93	
020	STO 42			STO 42			7 07	
	1 01			0 00		095	X 65	
	8 08			7 07			( 53	
	RCL 43		060	6 06			RCL 43	
	1 01			*RTN 56			1 01	
025	0 00			*LBL 46			4 04	
	*D' 19			*D' 19		100	X 65	
	STO 42			÷ 55			. 93	
	1 01		065	( 53			0 00	
	2 02			STO 42			2 02	
030	RCL 43			+ 85			1 01	
	1 01			3 03		105	+/- 94	
	1 01			5 05			) 54	
	*D' 19		070	) 54			INV 22	
	STO 42			= 95			lnx 23	
035	1 01			*RTN 56			) 54	
	3 03			*LBL 46		110	X 65	

TITLE GM-5 (continued)

**SR 52**

C-44

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	( 53			. 93		185	3 03	
	( 53			0 00			+/- 94	
	. 93		150	0 00			) 54	
	2 02			9 09			INV 22	
115	8 08			+/- 94			lnx 23	
	- 75			X 05		190	+ 85	
	. 93			RCL 43			. 93	
	0 00		155	1 01			4 04	
	0 00			5 05			X 05	
120	6 00			) 54			( 53	
	5 05			INV 22		195	RCL 43	
	4 04			lnx 23			1 01	
	X 05		160	+ 85			5 05	
	RCL 43			( 53			X 05	
125	1 01			. 93			. 93	
	4 04			2 02		200	2 02	
	) 54			3 03			+/- 94	
	X 05		165	+ 85			) 54	
	( 53			. 93			INV 23	
130	RCL 43			6 00			lnx 22	
	1 01			0 00		205	= 95	
	5 05			0 00			STO 42	
	X 05		170	6 06			1 01	
	. 93			6 00			4 04	
135	0 00			X 05			- 75	
	0 00			RCL 43		210	1 01	
	2 02			1 01			= 95	
	3 03		175	4 04			*if 80	
	+/- 94			) 54			*1 87	
140	) 54			X 05			RCL 43	
	INV 22			( 53		215	1 01	
	lnx 23			RCL 43			4 04	
	+ 85		180	1 01			*RTH 56	
	. 93			5 05			*LBL 46	
145	3 03			X 05			*1 87	
	X 05			. 93		220	1 01	
	( 53			0 00			*RTN 56	



TITLE GM-6

**SR 52**

C-45

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		X	65		X	65
	A	11		RCL	43	075	RCL	43
	CLR	25		0	00		1	01
	(	53	040	3	03		8	08
	RCL	43		X	65		X	65
005	1	01		RCL	43		(	53
	6	06		0	00	080	RCL	43
	+	85		9	09		0	00
	RCL	43	045	)	54		7	07
	0	00		+	85		X	65
010	1	01		RCL	43		RCL	43
	)	54		0	00	085	1	01
	X	65		4	04		3	03
	(	53	050	X	65		X	65
	(	53		RCL	43		RCL	43
015	1	01		0	00		0	00
	-	75		3	03	090	5	05
	RCL	43		X	65		+	85
	1	01	055	RCL	43		RCL	43
	3	03		0	00		0	00
020	)	54		9	09		3	03
	X	65		=	95	095	X	65
	RCL	43		STD	42		RCL	43
	0	00	060	0	00		1	01
	7	07		0	00		2	02
025	X	65		RCL	43		X	65
	RCL	43		0	00	100	RCL	43
	0	00		2	02		0	00
	5	05	065	-	75		9	09
	+	85		1	01		=	95
030	(	53		=	95		SUM	44
	1	01		INV	22	105	0	00
	-	75		*ifzro	90		0	00
	RCL	43	070	*3	89		RCL	43
	1	01		RCL	43		0	00
035	2	02		1	01		0	00
	)	54		7	07	110	X	65

## PROGRAM FORM

[illegible]

TITLE GM-7**SR 52**

C-47

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			0 00				STO 42
	A 11			7 07		075	1 01	
	RCL 43			GTO 41			4 04	
	0 00		040	*8 08			RCL 43	
	8 08			*LBL 46			0 00	
005	+/- 94			*9 09			8 08	
	+ 85			. 93		080	- 75	
	. 93			2 02			1 01	
	8 08		045	2 02			= 95	
	= 95			+ 85			*if <sub>210</sub> 90	
010	INV 22			( 53			*7 07	
	*if <sub>pos</sub> 80			RCL 43		085	RCL 43	
	*9 09			1 01			1 01	
	RCL 43		050	5 05			5 05	
	0 00			- 75			- 75	
	1 01			3 03			3 03	
	STO 42			) 54		090	= 95	
	1 01			÷ 55			INV 22	
	4 04		055	( 53			*if <sub>210</sub> 90	
	RCL 43			RCL 43			*6 79	
020	0 00			1 01			. 93	
	3 03			5 05		095	9 09	
	*A' 16			+ 85			PROD 49	
	*PROD 49		060	1 01			1 01	
	0 00			2 02			4 04	
025	3 03			0 00			GTO 41	
	RCL 43			= 95		100	*7 07	
	1 01			4 <sup>x</sup> 45			*LBL 46	
	1 01		065	( 53			*6 79	
	STO 42			5 05			RCL 43	
	1 01			- 75			1 01	
	4 04			5 05		105	5 05	
	RCL 43			5 05			- 75	
	1 01			5 05			2 02	
	1 01			5 05			0 00	
	1 01			5 05			= 95	
	1 01			5 05			1 01	



TITLE GM-BR

**SR 52**

C-49

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			+/- 94			4 04	
	A 11			) 54		075	- 75	
	STD 42			INV 22			1 01	
	0 00		040	lnx 23			= 95	
	5 05			+ 85			INV 22	
005	*RTN 56			3 03			*if pos 80	
	*LBL 46			. 93		080	* 2 88	
	B 12			5 05			1 01	
	CLR 25		045	X 65			STD 42	
	( 53			( 53			1 01	
010	1 01			RCL 43			4 04	
	- 75			0 00		085	*LBL 46	
	3 03			6 06			* 2 88	
	. 93		050	X 65			RCL 43	
	5 05			2 02			1 01	
C	X 65			. 93			4 04	
	( 53			3 03		090	X 65	
	RCL 43			+/- 94			RCL 43	
	0 00		055	) 54			0 00	
	6 06			INV 22			0 00	
020	X 65			lnx 23			= 95	
	2 02			X 65		095	*RTN 56	
	. 93			( 53			*LBL 46	
	3 03		060	RCL 43			C 13	
	+/- 94			0 00			CLR 25	
025	) 54			5 05			RCL 43	
	INV 22			X 65		100	0 00	
	lnx 23			. 93			5 05	
	) 54		065	0 00			- 75	
	X 65			4 04			2 02	
030	( 53			+/- 94			. 93	
	RCL 43			) 54		105	5 05	
	0 00			INV 22			= 95	
	5 05		070	lnx 23			INV 22	
	X 65			= 95			*if pos 80	
035	. 93			STD 42			* 3 88	
	1 01			1 01		110	1 01	

TITLE GM-7 (continued)

**SR 52**

C-48

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	*if pos 80			2 02		185	0 00	
	* 7 07			X 05			2 02	
	1 01		150	RCL 43			= 95	
	. 93			0 00			*if pos 80	
115	0 00			9 09			* 5 78	
	5 05			+ 85		190	2 02	
	*PROD 49			RCL 43			0 00	
	1 01		155	0 00			- 75	
	4 04			7 07			RCL 43	
120	*LBL 46			X 05			1 01	
	* 7 07			RCL 43		195	4 04	
	RCL 43			1 01			= 95	
	1 01		160	3 03			*if pos 80	
	4 04			X 05			* 5 78	
125	*PROD 49			RCL 43			RCL 43	
	0 00			0 00		200	1 01	
	3 03			5 05			4 04	
	*PROD 49		165	= 95			- 75	
	0 00			+ 85			7 07	
130	7 07			RCL 43			5 05	
	*LBL 46			0 00		205	= 95	
	* 8 08			0 00			*if pos 80	
	RCL 43		170	= 95			* 5 78	
	1 01			X 05			1 01	
135	7 07			RCL 43			. 93	
	X 05			1 01		210	2 02	
	RCL 43			9 09			*RTN 56	
	1 01		175	= 95			*LBL 46	
	8 08			STO 42			* 5 78	
140	X 05			0 00			1 01	
	( 53			0 00		215	*RTN 56	
	RCL 43			*RTN 56				
	0 00		180	*LBL 46				
	3 03			*A' 16				
145	X 05			- 75				
	RCL 43			. 93				
	1 01			0 00				

TITLE GMBR (continued)

**SR 52**

C-50

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	0 00			X 65		185	= 95	
	- 75			RCL 43			*LBL 46	
	RCL 43		150	0 00			* 5 78	
	0 00			5 05			STO 42	
115	5 05			) 54			1 01	
	= 95			INV 22		190	4 04	
	INV 22			lnx 23			GTO 41	
	*if pos 80		155	= 95			* 2 88	
	* 4 77			GTO 41				
120	• 93			* 5 78				
	8 08			*LBL 46		195		
	2 02			* 4 77				
	8 08		160	1 01				
	7 07			0 00				
125	X 65			y <sup>x</sup> 45				
	RCL 43			( 53				
	0 00			RCL 43				
	5 05		165	0 00				
	y <sup>x</sup> 45			5 05				
130	• 93			X 65				
	3 03			• 93				
	9 09			0 00				
	9 09		170	0 00				
	9 09			9 09				
135	+/- 94			3 03				
	= 95			8 08				
	GTO 41			+/- 94				
	* 5 78		175	) 54				
	*LBL 46			X 65				
140	* 3 89			RCL 43				
	( 53			0 00				
	• 93			5 05				
	2 02		180	y <sup>x</sup> 45				
	2 02			• 93				
145	4 04			3 03				
	8 08			8 08				
	+/- 94			+/- 94				



TITLE GE-1**SR 52**

C-51

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		)	54		*PRD	49
	*E'	10		*IF 200	90	075	1	01
	CLR	25		*1	87		4	04
	1	01	040	RCL	43		2	02
	9	09		0	00		*RTN	56
005	STO	42		3	03		*LBL	46
	0	00		*RTN	56	080	*2	88
	0	00		*LBL	46		*C'	18
	1	01	045	*1	87		2	02
	*RTN	56		*C'	18		INV	22
010	*LBL	46		0	00		*PRD	49
	*D'	19		*D'	19	085	1	01
	*IND	36		*RTN	56		6	06
	STO	42	050	*LBL	46		C	53
	0	00		A	11		RCL	43
015	0	00		*LBL	46		1	01
	INV	22		B	12	090	B	08
	*dsz	58		*LBL	46		+	85
	*D'	19	055	C	13		RCL	43
	C	53		*D'	19		1	01
020	2	02		STO	42		6	06
	0	00		0	00	095	)	54
	-	75		3	03		÷	55
	RCL	43	060	-	75		RCL	43
	0	00		5	05		1	01
025	0	00		=	95		7	07
	)	54		*IF 200	90	100	=	95
	*RTN	56		*2	88		INV	22
	*LBL	46	065	RCL	43		TAN	34
	*A'	16		0	00		-	75
030	*D'	19		3	03		C	53
	C	53		*RTN	56	105	C	53
	STO	42		*LBL	46		RCL	43
	0	00	070	D	14		1	01
	3	03		*D'	19		B	08
035	-	75		1	01		-	75
	4	04		+/-	94	110	RCL	43

TITLE GE-1 (continued)

**SR 52**

C-52

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	1	01		(	53	185	lux	23
	6	06		RCL	43		X	65
	)	54	150	1	01		.	93
	÷	55		9	09		7	07
115	RCL	43		X	65		4	04
	1	01		.	93	190	0	00
	7	07		0	00		5	05
	)	54	155	2	02		*LBL	46
	INV	22		3	03		*6	79
120	tan	34		9	09		=	95
	=	95		+/-	94	195	(	53
	÷	55		)	54		STO	42
	2	02	160	INV	22		1	01
	÷	55		lux	23		9	09
125	*↑	59		X	65		-	75
	=	95		1	01	200	1	01
	*PROD	49		.	93		)	54
	1	01	165	0	00		*ifpos	80
	9	09		0	00		*7	67
130	RCL	43		3	03		*RTN	56
	0	00		GTO	41	205	*LBL	46
	3	03		*6	79		*7	67
	*RTN	56	170	*LBL	46		1	01
	*LBL	46		*5	78		STO	42
135	*C1	18		(	53		1	01
	(	53		RCL	43	210	9	09
	(	53		1	01		*RTN	56
	RCL	43	175	9	09			
	1	01		X	65			
140	9	09		.	93			
	-	75		0	00			
	1	01		2	02			
	1	01	180	1	01			
	0	00		1	01			
145	)	54		+/-	94			
	*ifpos	80		)	54			
	*5	78		INV	22			

TITLE GE-2**SR 52**

C-53

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			7 07			1 01	
	A 11			STD 42		075	4 04	
	RCL 43			1 01			*E' 10	
	1 01		040	8 08			RCL 43	
	6 06			GTO 41			1 01	
005	*ifz 90			* 1 87			2 02	
	* 1 87			*LBL 46		080	*E' 10	
	RCL 43			* 2 88			RCL 43	
	1 01		045	RCL 43			1 01	
	8 08			1 01			3 03	
010	+ 85			8 08			*E' 10	
	RCL 43			+ 85		085	RCL 43	
	1 01			RCL 43			1 01	
	6 06		050	1 01			2 02	
	- 75			6 06			- 75	
(	RCL 43			= 95			RCL 43	
	1 01			X 65		090	1 01	
	7 07			2 02			3 03	
	= 95		055	= 95			= 95	
	*ifpos 80			*EXC 48			*E' 10	
020	* 2 88			1 01			RCL 43	
	RCL 43			7 07		095	1 01	
	1 01			X 65			2 02	
	8 08		060	2 02			+ 85	
	*X <sup>2</sup> 40			= 95			RCL 43	
025	+ 85			STD 42			1 01	
	RCL 43			1 01		100	4 04	
	1 01			8 08			= 95	
	7 07		065	*LBL 46			*E' 10	
	*X <sup>2</sup> 40			* 1 87			RCL 43	
030	= 95			7 07			1 01	
	*√X 30			STD 42		105	8 08	
	X 65			0 00			÷ 55	
	2 02		070	0 00			RCL 43	
	= 95			3 03			1 01	
035	STD 42			*E' 10			7 07	
	1 01			RCL 43		110	= 95	



## PROGRAM FORM

[illegible]

TITLE GE-3

**SR 52**

C-55

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			.	93		1	01
	A 11			3	03	075	)	54
	CLR 25			+	85		X	65
	RCL 43		040	.	93		(	53
	1 01			7	07		RCL	43
005	0 00			X	65		1	01
	*C' 18			(	53	080	5	05
	STO 42			RCL	43		X	65
	1 01		045	0	00		.	93
	0 00			1	01		0	00
010	RCL 43			X	65		0	00
	1 01			.	93	085	2	02
	1 01			0	00		2	02
	*C' 18		050	2	02		8	08
	STO 42			0	00		+/-	94
015	1 01			9	09		)	54
	1 01			+/-	94	090	INV	22
	4 04			)	54		lnx	23
	*RTN 56		055	INV	22		+	85
	*LBL 46			lnx	23		.	93
020	*C' 18			)	54		3	03
	( 53			X	65	095	X	65
	( 53			(	53		(	53
	STO 42		060	(	53		.	93
	0 00			.	93		0	00
025	1 01			2	02		0	00
	X 65			8	08	100	9	09
	.	93		-	75		+/-	94
	0 00		065	.	93		X	65
	4 04			0	00		RCL	43
030	0 00			0	00		1	01
	8 08			0	00	105	5	05
	+/- 94			5	05		)	54
	) 54		070	4	04		INV	22
	INV 22			X	65		lnx	23
035	lnx 23			RCL	43		+	85
	X 65			0	00	110	(	53

TITLE GE-3 (continued)

**SR 52**

C-56

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	.	93		X	65	185		
	2	02		.	93			
	3	03	150	2	02			
	2	02		+/-	94			
115	+	85		)	54			
	.	93		INV	22			
	0	00		lnx	23			
	0	00	155	=	95			
	0	00		STD	42			
120	6	06		0	00			
	6	06		1	01			
	X	65		-	75			
	RCL	43	160	1	01			
	0	00		=	95			
125	1	01		*ifms	80			
	)	54		*1	87			
	X	65		RCL	43			
	(	53	165	0	00			
	RCL	43		1	00			
130	1	01		*RTN	56			
	S	05		*LBL	46			
	X	65		*1	87			
	.	93	170	1	01			
	0	00		*RTN	56			
135	3	03						
	+/-	94						
	)	54						
	INV	22	175					
	lnx	23						
140	+	85						
	.	93						
	4	04						
	X	65	180					
	(	53						
145	RCL	43						
	1	01						
	5	05						



TITLE GE-4**SR 52**

C-57

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL 46			5 5			5 05	
	A 11			y <sup>x</sup> 45		075	- 75	
	CLR 25			. 93			3 03	
	RCL 43		040	0 00			= 95	
	0 00			1 01			*if 210 90	
005	6 06			9 09			* 8 68	
	*E' 10			3 03		080	*LBL 46	
	STO 42			+/- 94			* 2 88	
	1 01		045	+ 85			RCL 43	
	3 03			. 93			0 00	
010	RCL 43			1 01			0 00	
	0 00			5 05		085	- 75	
	7 07			8 08			. 93	
	*E' 10		050	4 04			2 02	
	STO 42			X 65			5 05	
015	1 01			RCL 43			= 95	
	4 04			1 01		090	if pos 80	
	5 05			5 05			* 8 68	
	*RTN 56		055	y <sup>x</sup> 45			. 93	
	*LBL 46			. 93			0 00	
020	*E' 10			2 02			1 01	
	STO 42			3 03		095	4 04	
	0 00			X 65			+/- 94	
	1 01		060	( 53			X 65	
	- 75			1 01			RCL 43	
025	1 01			- 75			1 01	
	= 95			RCL 43		100	5 05	
	*if 210 90			0 00			y <sup>x</sup> 45	
	* 9 69		065	1 01			. 93	
	. 93			) 54			3 03	
030	9 09			lnx 23			2 02	
	2 02			= 95		105	2 02	
	3 03			STO 42			6 06	
	4 04		070	0 00			- 75	
	X 65			0 00			8 08	
035	RCL 43			RCL 43			. 93	
	1 01			1 01		110	6 06	

## PROGRAM FOR IN

[illegible]

TITLE GE-5**SR 52**

C-59

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
000	*LBL	46		SUM	44		+	85
	A	11		1	01	075	RCL	43
	CLR	25		3	03		1	01
	RCL	43	040	X	65		3	03
	0	00		5	05		X	65
005	2	02		=	95		(	53
	*B'	17		STD	42	080	1	01
	STD	42		1	01		-	75
	0	00	045	2	02		RCL	43
	2	02		RCL	43		1	01
010	RCL	43		0	00		8	08
	0	00		6	06	085	=	95
	3	03		*B'	17		STD	42
	*B'	17	050	SUM	44		0	00
	INV	22		1	01		4	04
015	SUM	44		2	02		RCL	43
	0	00		RCL	43	090	1	01
	2	02		0	00		2	02
	RCL	43	055	7	07		X	65
	0	00		*B'	17		RCL	43
020	5	05		STD	42		1	01
	*A'	16		0	00	095	6	06
	SUM	44		8	08		X	65
	1	01	060	RCL	43		RCL	43
	4	04		0	00		1	01
025	+/-	94		5	05		7	07
	+	85		*B'	17	100	+	85
	.	93		SUM	44		RCL	43
	1	01	065	0	00		1	01
	=	95		8	08		3	03
030	*PRDD	49		RCL	43		X	65
	0	00		1	01	105	(	53
	2	02		2	02		1	01
	RCL	43	070	X	65		-	75
	0	00		RCL	43		RCL	43
035	4	04		1	01		1	01
	*A'	16		6	06	110	7	07



TITLE GE-5 (continued)

**SR 52**

C-60

PROGRAM FORM

LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS	LOC.	KEY	COMMENTS
	=	95		RCL	43	185	+	185
	STO	42		0	00		1	01
	0	00	150	6	04		=	95
	6	04		-	75		STO	42
115	RCL	43		RCL	43		0	00
	0	00		1	01	190	0	00
	8	08		1	01		X	65
	X	65	155	X	65		.	93
	RCL	43		RCL	43		2	02
120	0	01		0	00		4	04
	6	06		4	04	195	-	75
	X	65		+	85		.	93
	RCL	43	160	RCL	43		1	01
	1	01		1	01		4	04
125	8	08		0	00		X	65
	+	85		X	65	200	RCL	43
	RCL	43		RCL	43		0	00
	1	01	165	0	00		0	00
	4	04		2	02		4 <sup>x</sup>	45
130	X	65		)	54		1	01
	(	53		X	65	205	.	93
	1	01		RCL	43		7	07
	-	75	170	0	00		5	05
	RCL	43		9	09		=	95
135	1	01		=	95		*RTN	56
	8	08		X	65	210	*LBL	46
	=	95		RCL	43		*B'	17
	X	65	175	1	01		*A'	16
	RCL	43		9	09		STO	42
140	1	01		=	95		X	65
	1	01		STO	42	215	5	05
	+	85		0	00		=	95
	(	53	180	0	00		*RTN	56
	RCL	43		*RTN	56			
145	1	01		*LBL	46			
	0	00		*A'	16			
	X	65		+/-	94			

D-A055 278

UTAH UNIV SALT LAKE CITY GRADUATE SCHOOL OF ARCHITECTURE F/G 9/2  
SERVICES TO DEVELOP POCKET COMPUTERS TO PERFORM PF CALCULATING --ETC(U)  
JAN 78 S W CRAWLEY DCPA01-76-C-0325

NL

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2 OF 2  
AD  
A055278



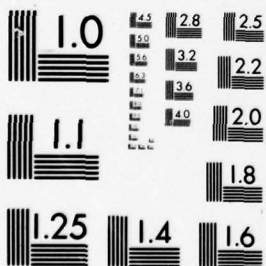
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7 -78

DDC

OF 2

55278



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

Co Process

2.6662  
0.3216  
-0.0224  
1.0290  
-0.0005  
-0.0167  
30.3000  
1.1670  
-0.2340  
-0.7345  
0.0000  
0.0000  
0.0000  
0.0000  
0.0000  
0.0000

See ne



Jack LeDoux's Process

reload All Registers as Follows:

Cg Process		Cg Process	
Card 1		Card 2	
-2.6606	0	-0.6666	0
352.3250	1	300.3280	1
220.1100	2	200.1100	2
46.0140	3	46.0140	3
0.0000	4	0.0000	4
0.0000	5	0.0000	5
0.0001	6	0.0001	6
5.7900	7	5.7900	7
17.4000	8	17.4000	8
-0.0239	9	-0.0239	9
0.0000	A	0.0000	A
0.0000	B	0.0000	B
0.0000	C	0.0000	C
0.0000	D	0.0000	D
0.0000	E	0.0000	E
0.0000	F	0.0000	F

for program listing.

Jack LeDoux's Process

## Program Listing

21 11	051	+	-55	101	RCL5	36 05	151	+	-55
16-51	052	YV	31	102	X	-35	152	STOD	35 14
35 12	053	RCL5	36 12	103	eV	33	153	RCL5	36 15
-31	054	RCL0	36 00	104	1	01	154	RCLC	36 17
-24	055	+	-55	105	.	-62	155	+	-55
35 00	056	RCL2	36 02	106	6	-06	156	STOD	35 13
16-53	057	X	-35	107	X	-35	157	RTN	24
-41	058	eX	33	108	CHS	-22	158	*LBL5	21 15
-31	059	X	-35	109	1	01	159	STOE	35 15
-24	060	RCL1	36 01	110	.	-62	160	R4	-31
35 01	061	X	-35	111	3	03	161	STOB	35 12
53	062	F1?	16 27 01	112	+	-55	162	GT05	22 05
04	063	GT07	22 07	113	X	-35	163	RTN	24
-35	064	F0?	16 23 00	114	STOD	35 00	164	*LBL6	21 12
35 00	065	GT04	22 04	115	RTN	24	165	SF0	16 21 00
53	066	STOA	35 11	116	*LBL6	21 00	166	CSBA	23 11
-55	067	STOC	35 13	117	X=0?	16-43	167	CF0	16 22 00
01	068	RTN	24	118	GT03	22 03	168	RTN	24
-55	069	*LBL1	21 01	119	P2S	16-51	169	*BLC	21 13
54	070	P2S	16-51	120	ENT1	-21	170	SF1	16 21 01
36 01	071	RCL5	36 15	121	ENT1	-21	171	CSBA	23 11
-35	072	RCL5	36 09	122	RCL6	36 00	172	CF1	16 22 01
00	073	YK	31	123	X	-35	173	RTN	24
-35	074	RCL5	36 15	124	eX	33	174	*LBL7	21 07
53	075	RCL8	36 08	125	RCL5	36 05	175	RCLC	36 13
36 00	076	YK	31	126	X	-35	176	-	-55
-35	077	+	-55	127	X2Y	-41	177	R/S	51
16 43	078	-RCL7	36 07	128	-RCL4	36 04	178	CSB6	23 06
00	079	X	-35	129	X	-35	179	X	-35
00	080	F1?	16 27 01	130	eX	33	180	RCLC	36 14
-24	081	GT07	22 07	131	+	-55	181	+	-55
35 15	082	F0?	16 27 00	132	-RCL3	36 03	182	STOD	35 14
16-51	083	GT04	22 04	133	X	-35	183	RTN	24
21 05	084	STOA	35 11	134	STOI	35 46	184	*LBLD	21 14
00	085	STOC	35 13	135	P2S	16-51	185	RCLA	36 11
35 00	086	P2S	16-51	136	RTN	24	186	RCLD	36 14
35 12	087	RTN	24	137	*LBL3	21 03	187	+	-55
16-43	088	*LBL2	21 02	138	1	01	188	STOB	35 12
22 01	089	RCL5	36 15	139	STOI	35 46	189	0	00
-62	090	RCL9	36 09	140	RTN	24	190	STOC	35 13
01	091	YK	31	141	*LBL4	21 04	191	STOD	35 14
36 15	092	RCL9	36 09	142	RCLA	36 11	192	STOA	35 11
16 51	093	X	-35	143	-	-45	193	CF0	16 22 00
16-34	094	RCL5	36 15	144	R/S	51	194	CF1	16 22 01
23 02	095	RCL7	36 07	145	X2Y	-41	195	RCLB	36 12
35 15	096	YK	31	146	STOE	35 15	196	RTN	24
35 12	097	RCL6	36 06	147	X2Y	-41	197	R/S	51
36 04	098	X	-35	148	CSB6	23 06			
-35	099	+	-55	149	X	-35			
36 03	100	RCL5	36 12	150	RCLC	36 14			